COMPLETION OF THE PENNSYLVANIA RAILROAD EXTENSION AT NEW YORK

SCIENTIFIC AMERICAN

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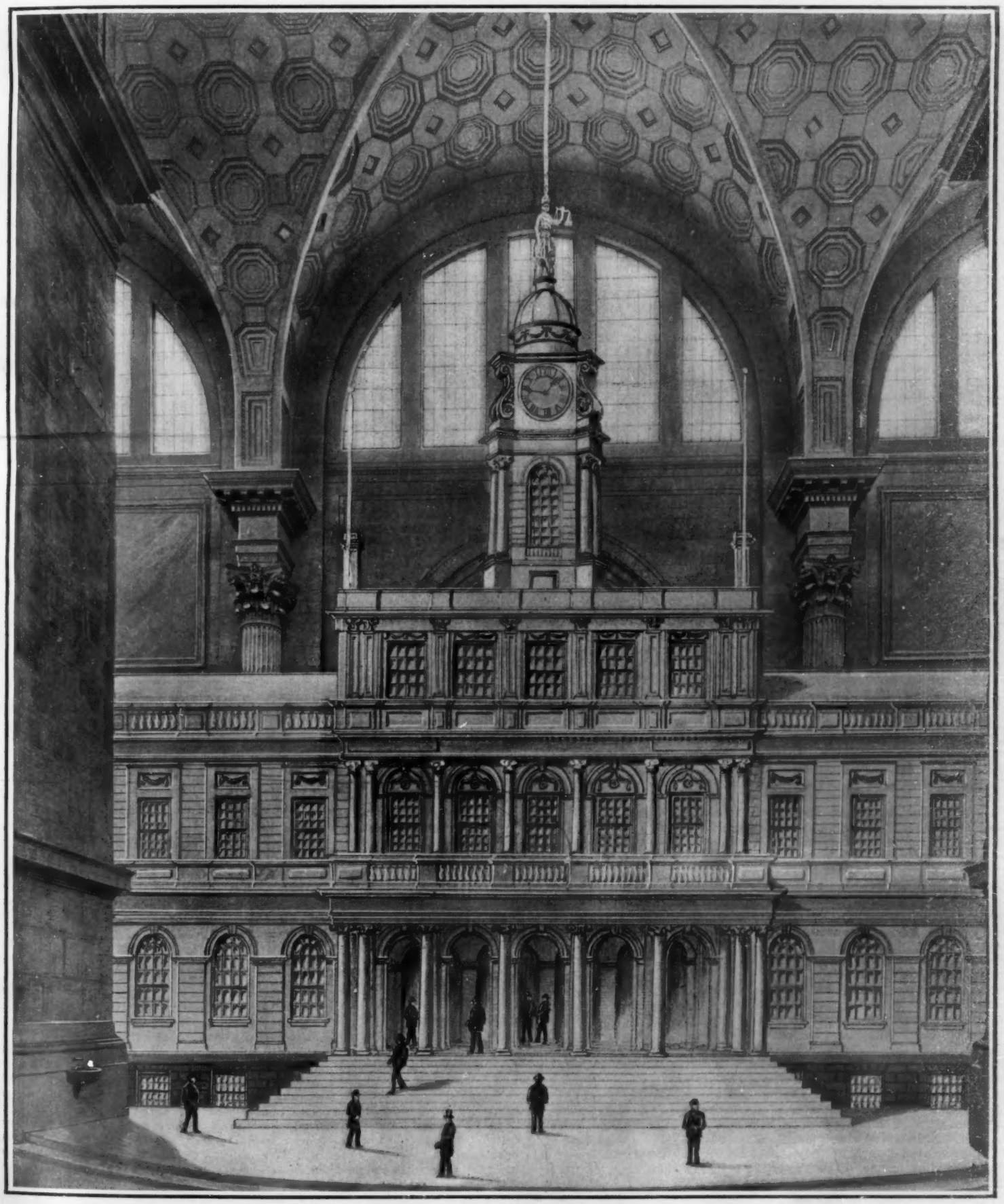

Interior view of the magnificent waiting room which is so spacious that it could contain, bodily, the New York City Hall. The ceiling, 150 feet above the floor, would clear the flagpole by 10 feet.

COMPLETION OF THE PENNSYLVANIA RAILROAD TUNNELS AND TERMINAL STATION.—[See page 398.]

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, MAY 14th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

NEW QUEBEC BRIDGE DESIGN.

ACCORDING to a recent dispatch to one of the New York dailies, the Quebec Bridge Board "after extended investigation," has approved a plan for the superstructure of a cantilever bridge to take the place of the one which collapsed several years ago. It is also announced that tenders for construction will be accepted either on this design or on satisfactory alternative designs submitted by bidders. It is stated, furthermore, that the Dominion government will require not only that the contracting firm accept full responsibility for the project, whether it be constructed on the Board's design or from its own plans, but also that the firm make a very large cash deposit as guarantee of successful completion of the work.

"The design now approved by the Commission," says the dispatch, "is that which was sharply criticised a few months ago in an American scientific periodical"; and we are informed in this connection that the Canadian government "has decided that the criticism then made did not justly apply." We are further told that "the Board, while convinced that the designs will make a safe and satisfactory bridge, is not disposed to close the door to other designs."

Since the SCIENTIFIC AMERICAN is the only journal that has printed the plan of the new design drawn up by the Board, and subjected it to extended criticism we presume that we are the American scientific periodical referred to. The plan and discussion was printed in our issue of February 12th; and our readers will remember that we took exception to the design on the ground that it was not only of inferior merit, considered from the bridge engineer's stand-point, but that if constructed it would be the "ugliest bridge of monumental proportions among those hitherto proposed or built." Objection was also made to the design on the ground that, because of its narrow width, it would not have sufficient rigidity, the Forth bridge, which is of less span, having a ratio of width to length of 1 to 14, whereas the Quebec bridge would have a ratio of only 1 to 20. We objected, furthermore, to the height of the towers, which in the Board's design, is to be only 290 feet, as against a height of 315 feet in the bridge which fell at Quebec, and of 330 feet in the Forth bridge. We showed also that the effect of low height and narrow width had been to unduly increase the weight of the structure, the Quebec bridge requiring the enormous average weight of 24 tons of steel (half of it nickel steel) per linear foot, as against a weight of only 10 tons of carbon steel per linear foot in the Forth bridge—an increase out of all proportion to the heavier loading of the proposed Quebec structure.

The value of the Board's decision to invite outside designs depends upon the length of time that is allowed to bidders for the proper preparation of plans for a structure of this great importance. The Board has taken about two years to prepare its own plan; and if outside bidders are to be limited to a few months' time, it is scarcely likely, in view of the heavy penalties imposed, that they would be prepared to put in bids which they must, perforce, have thrown together very hastily. If the competition is to be thrown open to the designers and bridge builders of the United States and Europe, not only should abundance of time be given for the working up of the necessary plans and estimates, but it would be advisable for the Canadian government to arrange for the plans, both of the Quebec Bridge Board and of outside bidders, to be subjected to the award of an independent Board, preferably international in character.

FUEL ECONOMY AND OUR NATURAL RESOURCES.

THE problem of preserving the natural wealth of the country may be attacked from two sides, the legislative and the mechanical. The operation of the first method may be seen in the admirable movement of the Federal government to prevent the ruthless waste of the country's natural resources which results from the improvident methods by which they are gathered from mine, field, and forest. Only posterity will be able to estimate at its full value the recent legislation for the conservation of that natural wealth with which the United States has been so richly endowed.

But after the fostering care of the government has done all that it may to conserve by the prevention of waste, it remains for the consumer to so utilize the raw materials, as to obtain from them the maximum amount of useful output, whether in the form of power or of finished product, with the least possible amount of wastage. This, indeed, is one of the most important and attractive objects of effort in the great industrial world. To the engineer of high professional instincts, it is not sufficient to do a certain work and do it fairly well; rather, it must be done with as close an approximation to perfection as the conditions of the art will allow.

Economy of performance has been the constant aim of the industrial engineer, particularly in recent years; and from time to time we have recorded in these pages certain successive steps, some of them epoch-making in their importance, in this constant endeavor to bring working efficiency into closer approximation to theoretical efficiency. What we have said applies with particular force in the field of steam engineering, in which it may be said that at the last analysis, the object of all improvements is to lessen the consumption of fuel for a given amount of work. Fuel economy, moreover, apart from its direct connection with the profit and loss account of any industrial enterprise, has a most important bearing upon the question of the conservation of natural resources. The world's coal supplies are by no means unlimited. The consumption, enormous as it is at present, is increasing at an accelerating rate; and every reduction that is made in the average amount of fuel which must be burned to secure a given amount of work, means that the life of our coal and oil fields is prolonged to exactly that extent.

At the present time there are two important developments which promise to give economical results whose value it would be difficult to overestimate. In both cases they have to do with the transportation of freight in bulk; the one relating to the engines of slow-speed cargo boats, the other in the motive power of those huge freight trains which are so characteristic of American railroads.

The reduction in the cost of transporting waterborne freight has been made possible, or soon will be, by the successful application of mechanical reduction gear to cargo ships of moderate speed—a problem to which some of the ablest engineers and the most renowned manufacturing firms in the world are now devoting close attention. MacFarland and McAlpine, and Westinghouse, in this country, and the Hon. Charles Parsons, in England, have independently produced a gear which will enable slow and moderate-speed steamships to utilize the highly economical fast-running steam turbine for driving slow-speed propellers with a loss of efficiency in the transmission gear of only two per cent. Parsons has gone so far as to test the new installation against the old reciprocating engines, in a cargo ship of 4,500 tons displacement; and he has proved, in a series of comparative tests, that the cargo ship of the future can be driven at present speeds with a saving in the coal bill of from 17 to 20 per cent. Now since about two-thirds of the world's shipping are made up of freight steamers, it can be seen that when some form of this system has been generally applied, as it undoubtedly will be, there will be a great aggregate reduction in the consumption of fuel by the world's merchant marine. For fuller information regarding this epoch-making device, reference is made to articles published in the SCIENTIFIC AMERICAN of February 12th and April 23rd of this year.

Equally important are the economies in the transportation of railroad freight which are now rendered possible by the perfection of appliances for the use of superheated steam. Although the application of superheat has been practised for several years in Europe, it is of comparatively recent introduction in this country; but although our engineers have been a little late in taking hold of the problem, they have done such good work that on one of our leading western roads, the Atchison, Topeka and Santa Fe, superheated steam is being used on a number of the largest freight engines with conspicuous success. In a series of tests with two identical compound freight engines running over the same stretch of road under identical conditions, one, a 4-cylinder compound using saturated steam, and the other a similar 4-cylinder compound with a superheater of the Jacobs type added, the superheater engine showed a decrease in coal consumption of 19.6 per cent for constant hard working on heavy mountain grades; it gave an average of 11.6 per cent more dry steam per pound of coal than the non-superheater engine; and the boiler and its accessories proved to have a total higher efficiency of 15.8 per cent. These figures were obtained by H. MacFarland, the engineer of tests of the railroad, who explains the remarkable economies secured by the facts: First, that superheated steam of high temperatures behaves somewhat like a gas, it being possible to extract a considerable amount of heat before any condensation takes place; secondly, that for the same cut-off in the cylinder, the weight of steam required is less with superheated than saturated steam of the same pressure; and thirdly, that, as compared with saturated steam, superheated steam has greatly reduced thermo-conductivity, and the amount of heat absorbed by the cylinder walls is only a fraction of what it would be were the steam saturated. The details of this system of superheating as applied to locomotives of the Mallet type will be found in an illustrated article published in our issue of January 29th of the present year.

Important as are the economies that have been made possible in the broad field of transportation, they are exceeded in the even larger field of stationary engineering represented by the huge light and power plants for municipal and manufacturing service, where the utilization of the exhaust steam in low-pressure turbines has made possible economies of from 30 to 100 per cent—this last result having been attained at the large station which furnishes power for the New York subway.

DOES RADIUM EXIST IN THE PURE STATE?

THE French scientist G. Le Bon doubts whether metallic radium exists. In fact, we are only acquainted with the salts of the supposed metal, such as the chloride or bromide, and the probability of its existence is deduced only from the presence of some rays of the spectrum and an atomic weight which is somewhat theoretical, seeing that it has varied according to the observers. M. Le Bon has been of the opinion for eight years past that the existence of radium is doubtful. He considers that the properties of the supposed metal might be due to certain unknown combinations analogous to the equally unknown combinations which give phosphorescence to some of the sulphides. It is observed in fact that a pure sulphide is never phosphorescent, but when mixed with some traces of different bodies it becomes brilliantly phosphorescent. This point has been discussed in various papers presented to the Academie des Sciences. He had occasion to mention his views about radium to the late Prof. Moissan, and this well-known chemist had in fact come to the same conclusion, having the idea of separating radium from its compounds. Death overtook him before he could carry out these researches. A tenth of a gramme of substance would be needed by a good chemist, but probably several operations would be required in addition. An expense of $10,000 would be incurred. M. Le Bon thinks that from chloride of radium we would extract simply barium and nothing more. The experiment, even through transforming a body worth $20,000 a gramme into a comparatively worthless metal, would be of great interest, for it would prove that radio-activity which gives out considerable force can be produced by certain combinations.

M. Georges Claude of Paris brings out the following points regarding the future uses of oxygen, seeing that this latter is now being produced on a commercial scale from liquid air. He shows that oxygen can increase by 40 per cent the yield of the reactions which serve as the base of the fixation of nitrogen by the electric arc, and it can improve the manufacture of ozone by nearly 300 per cent. Such results promise to be of great interest in many of the industries. The Belgian firm of Ougree Marihaye has recently ordered from the Paris Liquid Air Company three apparatus for producing oxygen, and these each have a yield of 200 cubic yards of pure oxygen per hour. Such apparatus will be used for experiments in blast furnace working, to observe the action of a considerable proportion of oxygen mixed with the air, which is sent into the blast furnaces. As to the price of oxygen, although this may be comparatively high when we consider only small quantities, the result changes when we come to using oxygen apparatus of the present kind, and we may count upon a price of 0.64 cent per cubic yard with apparatus of a large output such as we mention. However, even larger apparatus can be built in which no less than 1,000 cubic yards of gas per hour can be produced, working at a pressure of 10 atmospheres and furnishing 1.5 cubic yards per horse-power hour. In such case the price per cubic yard will fall as low at 0.5 cent. By using hydraulic power the cost of production can be still lowered. Oxygen plants of the present kind will be of great advantage in the way of small space occupied, seeing that a small factory occupying 60 by 100 feet can hold all the material needed for producing 50 million cubic yards of oxygen annually, with about 15 employees.

ENGINEERING.

The German estimate of aeronautical statistics for the year 1910 is that Germany will have fourteen dirigibles and five aeroplanes; France, seven dirigibles and twenty-nine aeroplanes; Italy, three dirigibles and seven aeroplanes; Russia, three dirigibles and six aeroplanes, and England, two machines of each kind.

The activity in railroad construction in the Northwest is answerable for the construction of several important bridges across the larger rivers. A notable instance of this is the Columbia River bridge on the North Coast Railway in Washington, the permanent sub-structure of which will consist of twelve piers, carrying a superstructure made up of nine Howe truss spans, and a draw span across the main channel.

A leading southern journal speaks words of wisdom when it says that the policy of navy yard construction of battleships should be adhered to, even if it costs a trifle more than building in private yards. Keeping our leading navy yards busy with warship construction not only serves as a stimulus to private contractors, but it has the important effect of maintaining the navy yard forces intact, with a large body of skilled workmen ready at all times to undertake emergency work.

The loss of the Atlantic transport liner "Minnehaha" upon the much-dreaded rocks at the western end of the Scilly Islands reminds us again that, in spite of the additional safeguards which have been introduced of late years in trans-Atlantic navigation, the perils of the sea are still insistent. The great success of the submarine bell on our Atlantic coast suggests that this device might be used to very good effect at the more dangerous points at the approaches to the British Isles.

Nobody seriously disputes the advantages of the "Pay-as-you-enter" car. Not the least among these is the reduction which it has made, at least on certain lines, in the number of accidents. Statistics compiled by the Chicago City Railway show that the complete introduction of this style of car on all trunk lines has resulted in a decrease of accidents of about thirty-two per cent, as compared with the number occurring during equal periods of service with the old style of cars which it replaced.

The building of railroads through mountainous country occasionally necessitates some daring bridge construction. A recent instance of this is the Assopus viaduct, which forms part of a new line extending by way of Demirli to the Turkish frontier. The structure, which is 600 feet long and spans a gorge 330 feet deep, serves to connect two tunnels which open from either side of the gorge. The superstructure which is very graceful in design consists of latticed trusses carried upon two hinged arches. The bridge is on a grade of about two per cent, and the line is laid on a curve of four degrees.

Recent tests at Sandy Hook of the resisting power of reinforced concrete as a defense against high-powered projectiles confirm the calculations of the penetrating power of the twelve-inch gun. It is stated that a concrete wall twenty feet thick, heavily reinforced with steel beams, was pierced by a twelve-inch projectile fired at high velocity. We understand that a similar attack is to be made with the new fourteen-inch gun. The blow delivered was sufficient to penetrate twenty-two inches of armor plate, and the reinforced concrete withstood the attack so well that it will probably be used in the construction of the new coast defense fortifications in the Philippines.

The electric operation of trains through the Saint Clair tunnel is showing the same economies, as compared with steam operation, as have been obtained in similar installations elsewhere. According to the Electric Railway Journal, the cost of coal for one year under electric operation was only thirty-nine per cent of that for the last year of steam operation. The total service charges were but sixty per cent of those for steam, and the sum of service and fixed charges was 84.5 per cent, which represents the operating economy of the new over the old service. The cost of maintenance and repairs for the electric system is fifty-five per cent of that of steam during the same period.

Considerable interest has been aroused by the launch of the new torpedo-boat destroyer "Paulding" at the Bath Iron Works. She will be the first destroyer in our navy designed for the exclusive use of oil fuel. Except for this, she is practically a sister vessel to the "Flusser" and the "Reid," and like them she will be driven by turbines, and must make a speed of 29½ knots on a four hours' run at sea. It is well here to correct the statement, which recently went the round of the press, that the "Flusser" made 36 knots recently in the Gulf of Mexico. As a matter of fact, her speed on that occasion was between 30 and 31 knots. Her best speed was made on her acceptance trials, when she steamed at an average speed of 33.75 knots. The fastest destroyers are the oil burners of the British navy, which made on trial between 35 and 36 knots.

ELECTRICITY.

In Rochester, N. Y., a good system of electric light and telephone wiring is in use, whereby unsightly pole lines on the streets are done away with. The system is applicable chiefly to the residential districts. The lines are placed in underground conduits in the streets, but instead of making connections with the houses directly from the underground conduits, a pole line is erected in the back yards of each block and this pole line is connected to the conduits by an underground branch at each side street. This obviates the necessity of having a manhole in front of each house.

An application was recently made for a permit to lay conduits along the new Baltimore and Wilmington road. These are to form part of an underground trunk system connecting Boston, New York, Philadelphia, Baltimore, and Washington, in which the American Telephone and Telegraph Company will run its lines. The conduits will be laid just below frost line, and will contain a hundred wires, which can be tapped at any point. It is stated that the system will serve as an auxiliary for the overhead wires, which occasionally are put out of order by severe storms. It is expected that after the line connecting Boston and Washington is completed, the system will be extended West and South.

Storage battery locomotives are being used in certain mines of Germany. These locomotives are considered less dangerous than the ordinary electric locomotive, for the reason that no wiring is necessary in the mines, and they can be incased completely to prevent ignition of gases by means of a chance spark. The locomotives are each provided with two sets of batteries, one of which is being charged while the other is operating the locomotive. The batteries are seldom more than two-thirds discharged, so that the re-charging takes but a short time. In one type of locomotive of twenty horse-power the batteries contain ninety cells, each with a capacity of 74 ampere hours. The storage battery locomotives range from 8 to 32 horse-power.

Whenever a cable message is sent to an inland city, it is necessary to transcribe the message from the cable receiver and re-transmit it by hand over the land lines to its point of destination. Heretofore it has been impossible to send a message directly to the inland city by means of relay connection with the overland wires, for the reason that the cable signals are of too fluctuating a character and too sensitive to operate an ordinary telegraph relay. Recently, a system has been devised which promises to make direct connection between the cable and telegraph systems commercially practicable. A very sensitive relay is used, and the character of the signal is changed so as to obviate the usual fluctuations. By means of this new system, a cable message was recently sent from Canso, Nova Scotia, to New York, a distance of 800 miles, and here relayed to Chicago.

The installation of a complete telephone system for the stage of the New Theater in this city illustrates not only the variety of uses to which the telephone is put, but also the vastness and complexity of the up-to-date stage. The stage telephone system has nine stations on the stage and twenty-five floor stations with two switchboards or central stations. Through these centrals, inter-communication with the other stations may be had. From one of these central stations the technical director controls the operations of the stage hands, while the other board is the stage manager's station. The regular stations are placed in the prompter's booth, the electrician's booth, the stage galleries, and one is located near the orchestra leader. Calls are made by operating push buttons from either of the central stations, and they serve to flash a bull's-eye signal or to operate a buzzer, depending upon which of two buttons is pressed. The theater is also equipped with a telephone system, used for carriage calls.

The Pennsylvania's tunnel and terminal signal installation is the largest single installation of its kind ever made in this country. While most people realize that signals play an important part in protecting train movements, especially where traffic is congested, the investment made in these devices is far beyond the general understanding. Development in signaling in recent years has been tremendous and has proceeded chiefly along electrical lines. Complete signaling and interlocking of a double or four-track road requires a large amount of electrical apparatus, and the introduction of electrical propulsion complicates the situation. We are informed by the Kerite Insulated Wire and Cable Company, who supplied the wire and cable for the Pennsylvania Terminal, that frequently the cost of electrical wires and cables is from 20 to 30 per cent of the entire cost of the installation. Not only from the standpoint of safety, but from that of reliability and punctuality of train service it is necessary that the wires and cables controlling the intricate apparatus should be the best. Millions of feet of wire and cable conductors are being used in this installation.

SCIENCE.

Prof. W. W. Campbell, director of the Lick Observatory, has telegraphed to Harvard College Observatory that the bright sodium D line has been photographed in the spectrum of Halley's comet by Wright.

Prof. Charles Chandler was honored in New York city recently on his retirement, in his 74th year, from active service. A banquet was tendered him at the Waldorf-Astoria hotel. The banquet was attended by many of New York's most distinguished scientists.

Commander Peary's arrival in England was attended with much ceremony. A regiment of reporters met him at Plymouth. Members of the Royal Geographical Society, as well as the London Naval Attache, welcomed him to London. With Commander Peary is Capt. Bartlett, who accompanied him to the pole. A special gold medal was presented to Commander Peary by the Royal Geographical Society, and a replica in silver to Capt. Bartlett.

A letter dated May 1st, 1910, has been received at Harvard Observatory from Prof. D. W. Morehouse of Drake University, stating that "This morning at 4 o'clock Halley's comet had a short, bright tail projecting toward the sun. Two bright rays bordered the outer part of this sector, forming an angle with the nucelus of about 86 degrees. The south preceding one was much the brighter. The nucleus was surrounded on the sun side with distinct nebulous sheaths. Smyth's observation of October 11th, 1835, was vividly recalled. A photograph of 14 minutes' exposure showed a tail of over 2 degrees in length."

The lowest atmospheric temperature ever observed, —68 deg. C.(—90.4 deg. F.) was recorded on January 15th, 1885, at Werchojansk in Eastern Siberia, a little north of the Arctic Circle. No lower temperature than this has been experienced by any Arctic or Antarctic expedition. A temperature of —59 deg. C. (—74.2 deg. F.) was observed in 1876 at 82½ degrees north latitude, and the lowest temperature observed by Nansen, at 85 degrees north latitude, was —53 deg. C. (—63.4 deg. F.). The assertion of Dr. Cook, who claims to have observed a temperature of —64 deg. C. (—83.2 deg. F.) at 74 degrees north latitude, in February, 1908, cannot be accepted without reserve.

The United States Weather Bureau has issued instructions to all its regular stations calling for observations on the 17th, 18th and 19th of May, of any optical, electrical or other phenomena that may be occasioned by the passage of the earth through the tail of Halley's comet. Up to date the development of the tail has been disappointingly slow, and it may not extend so far as the earth on the date of transit; should it do so, however, it can hardly fail to make its presence manifest by disturbances in the atmosphere recognizable by the trained observer, if not by the layman. Such phenomena as mark the occurrence of an abnormal amount of dust in the atmosphere—e. g., red sunsets, "Bishop's ring," and the singular "noctiluminous clouds" that were frequently observed after the eruption of Krakatoa—are especially to be looked for.

A monograph bearing the title "Quality of Surface Waters in the United States" has been issued by the United States Geological Survey. The volume, which is the work of R. B. Dole, contains the results of over 5,000 mineral analyses of water from the principal rivers of the United States east of the Rocky Mountains. Daily samples of water from nearly 200 stations were collected for a year, united in lots of ten consecutive samples from the same stream and station, and the composition subjected to analysis. The analyses, giving, as they do, the average composition from day to day, and information regarding change of water level wherever available, form the most complete collection of data regarding the quality of American rivers that has ever been published. They are on this account particularly valuable to managers of industrial plants and water works.

During the past winter Prof. Hergesell, of Strasburg, president of the International Committee on Scientific Aeronautics, carried out a series of daily meteorological observations with sounding-balloons over the Atlantic Ocean in the region between Teneriffe and the West Indies. The average altitude attained was 15,000 meters, and the maximum 17,600 meters, which is the record for such observations at sea. The lowest temperature yet measured over the sea was also attained; viz., 30.5 deg. C. (94 deg. F.). During December a strong trade-wind, average 14 meters per second, blew over the Atlantic, up to an average altitude of 5,000 meters. Immediately above this there was an unusually strong anti-trade, which had, at an altitude of 8,000 meters, a velocity of 30 to 40 meters per second. The latter wind must have carried an enormous volume of warm air from the tropics to Europe, and the unwonted strength of this current may have had something to do with the abnormally mild winter that has prevailed over that continent. The isothermal layer was reached at an altitude of 16,000 meters; i. e., 4,000 to 5,000 meters higher than it occurs, on an average, over Europe.

The Porhydrometer—An Apparatus for Weighing Ship Cargoes

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN

An ingenious apparatus has been perfected by an Italian engineer, Signor Emilio de Lorenzi, the function of which is to indicate automatically the weight of a ship's cargo. This device, which is called the "Porhydrometer," is of simple construction and operation, and works with remarkable accuracy—the results being within 0.001 per cent. Moreover, it is easy of installation, so that vessels already in service can be equipped therewith as readily as those in course of construction.

The operation of the instrument is based upon the principle that a body floating in a liquid, no matter what its density may be, displaces a quantity of that liquid exactly equal to its own weight. The apparatus comprises merely a float or "aerometer" placed in a chamber filled with water, which is in communication with the outside of the ship. Consequently, as the vessel sinks deeper into the water while being loaded or *vice versa* when the freight is being discharged, the level of the water in the float chamber must rise or fall in coincidence with the level of the surrounding liquid outside. The float itself being fixed, it becomes more or less deeply immersed in the water in the chamber with a consequent alteration in its apparent weight.

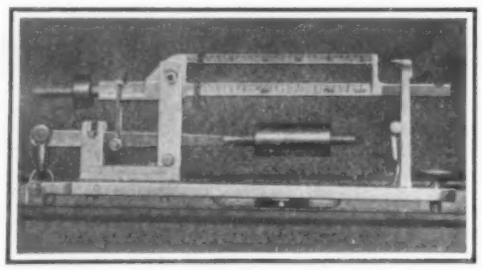
The aerometer is connected and balanced by levers, so that by the adjustment of the balancing weights the volume of water displaced by the aerometer at any particular draught is accurately gaged, the alteration in apparent weight being read on the weighing machine or recording instrument, and therefrom the weight of any cargo taken on board or discharged is easily determined.

The principle of the apparatus may be more comprehensively realized by reference to the explanatory illustration, which shows the mid-ship section of a vessel with the porhydrometer in position. The float chamber *A* is placed vertically over the longitudinal and transverse center of the ship, and extends from a point 1½ to 2 feet below the line of flotation when the vessel is empty to a convenient height above the load line. This chamber is connected to the surrounding liquid by means of a smaller pipe *B* to a valve on the skin of the vessel, or to some other convenient sea water connection, a special tube being unnecessary so long as an uninterrupted flow of water to the float chamber can be secured, so that the water level within may be exactly as that outside the ship. In the large float chamber *A* is immersed the aerometer *C*, being suspended from, and balanced by a horizontal lever *D* having its fulcrum at *E*, the other end being connected to a steelyard weighing machine at *F*. The aerometer is generally made heavier than its displacement, but this is immaterial, since it is in a condition of equilibrium. The float extends downward sufficiently to bring its lower end below the plane of flotation for light loading, and sufficiently far upward to bring its upper end above the plane for the maximum draught. Moreover, its profile is such that the area of the float at any point of cross section bears a constant ratio to the area of the ship at the same level.

As the vessel becomes immersed through the superimposition of any weight, such as cargo, the draught increases, and accordingly the water in the float chamber rises to a higher level, the aerometer itself consequently being immersed deeper into the water, and by increasing its displacement reduces its apparent weight as already mentioned. This difference of weight creates a downward pull on the opposing arm of the lever, where a counterweight remains unaltered. As the steelyard is connected to the main lever *D* by tie rods or links, the exact amount of tension is registered that is attributable to the disturbance of the balance on the main lever through the increased displacement.

The vital part of the invention lies in the aerometer. Alteration of trim or inclination of the vessel cannot by any means upset the accuracy of the instrument. It is in short an absolute gage of the vessel's displacement. Should the cargo be placed right aft or forward it will be weighed exactly the same as if placed near the center of the vessel, since the draught directly under the instrument is the mean of that fore and aft. The whole of the parts of the apparatus are standardized with the exception of the aerometer, which must be properly designed and carefully adjusted, its form being made to correspond with that of the ship.

Numerous tests with the apparatus have been carried out in England, and the accuracy of the weight readings, irrespective of the size of the vesssel, have been remarkably conclusive. It can be applied to any type of craft with equal facility and infallibility—to a small lighter as easily as to a transatlantic liner. At the present moment arrangements are being made for its installation upon a 10,000-ton vessel. In this case the diameter of the float will be about 9 inches. For a small lighter it averages about 3¼ inches diameter at the top by about 2⅞ inches at the lower extremity. So sensitive is the apparatus that it will indicate the weight of a person stepping on board.

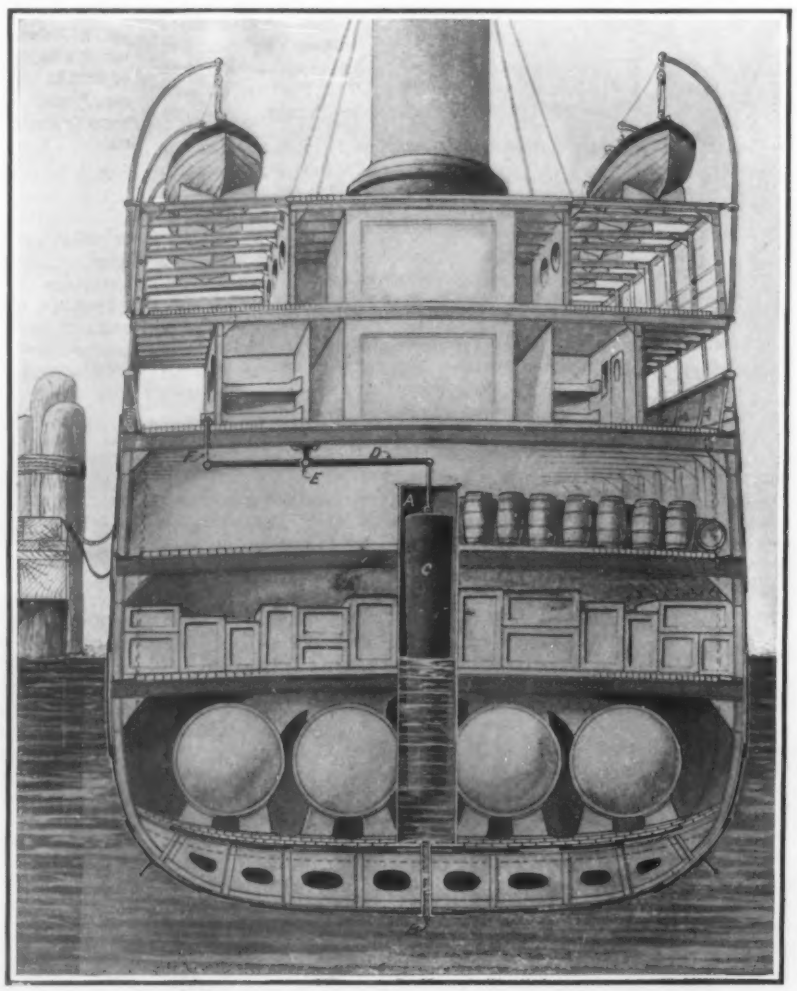


Recording instrument of the porhydrometer.

Thus it will be seen that the captain of a vessel always possesses a means of determining exactly the weight he has on board. For those vessels engaged in long journeys, necessitating bunkering at intermediate ports, it is of far-reaching importance, since it enables the captain to ascertain precisely how much fuel he has shipped. This is a valuable point, inasmuch as at many foreign ports short weighting is by no means an uncommon practice, and vessels are often mulcted for a considerable sum per annum in payments for misrepresented quantities of coal.

The function of the invention is also carried to a further and important feature. It will inform the captain the exact weight of water he has in his ballast tanks. Also, should the vessel spring a leak the fact is instantly communicated to the captain by the apparatus registering an increased weight or displacement due to filling with water. In cases of collision and grounding the incursion of water is similarly conveyed, the apparatus being equipped with an electric alarm bell, which conveys intimation of the danger to the captain. No discrepancies in the readings can be introduced by variations in the density of the water in which the vessel may be floating, for such cannot affect the fundamental principle upon which the apparatus works.

It will be seen that by the introduction of the apparatus the ship itself is practically converted into a huge weigh-bridge. The Italian government submitted the invention to searching tests and was so convinced of the accuracy of the records, that its customs authorities have been ordered to accept porhydrometer readings as correct. To the shipowner this is no slight concession, since in regard to Italy, instead of paying 4.5 cents per ton in weighing dues, vessels fitted with the porhydrometer only pay 1.25 cents per ton.



Sectional drawing of vessel, showing porhydrometer.

THE PORHYDROMETER—AN APPARATUS FOR WEIGHING SHIP CARGOES.

Influence of Phase and Rotation upon the Brightness of Illuminated Spheres.

The total luminosity of the moon varies according to the proportion of its illuminated hemisphere which is turned toward the earth, that is to say, in accordance with the "phase" of the satellite. Mercury and Venus show similar, but smaller differences of phase and brightness. The exterior planets vary in phase so little that the variation in their brightness is barely perceptible. The brightness of planets can be measured by the astrophotometer, and the dependence of the brightness upon the phase can be expressed by a curve. As it seemed possible that some information in regard to the surface of the planets could be obtained from the study of such curves, Von Aufsess has made a series of experiments to determine the relation between brightness and phase in the case of illuminated masses of limestone, sandstone, granite, and other materials of spherical and other forms. The measurements of brightness were made in a completely dark room. The artificial plant was illuminated by a Nernst lamp, not directly, but by reflection from a plane sheet of glass, through which the object could be observed in the "full" phase. The lamp and the reflector were mounted on an arm which could be turned around the object in order to vary the phase.

When the results were plotted, the curves representing the brightness as a function of the phase were found to fall into two classes, according to the character of the material to which the globes were composed. Globes of light colored material gave curves concave below, while the curves produced by globes of darker material are concave above. Small elevations and depressions, glossy surfaces, etc., were found to produce comparatively little effect upon the curves, the character of which was, in general, decided almost entirely by the lightness or darkness of the surface. The curves produced by Venus and the moon are concave above. Hence it appears probable that the surfaces of these two planets are formed of dark colored material.—Prometheus.

In a recent issue of Nature the difficulty experienced in hot countries in keeping small accumulators in working order is referred to, and it is pointed out that this is probably due to the cells being filled with dilute acid of density 1.190 at a temperature of 30 deg. or 35 deg. Cent. While this is a proper density to use in a climate where the temperature is 15 deg. to 20 deg. Cent., corresponding to a 20 per cent mixture, it is too high for a hot climate, where it really represents a 23 per cent mixture; a density of 1.170 or even 1,150 is more suitable.

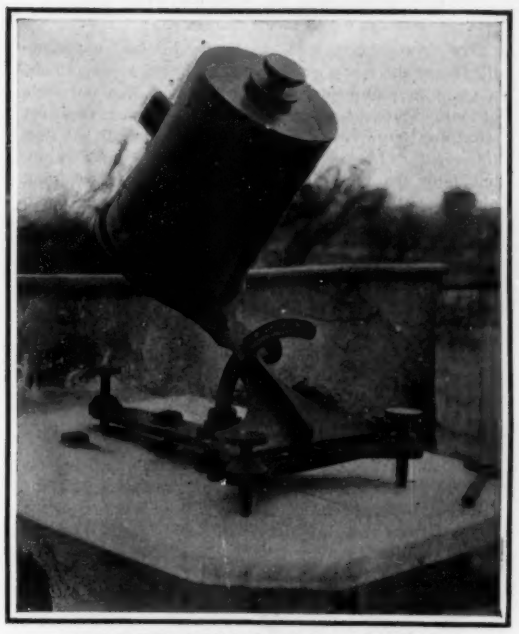
THE NEW EIFFEL PHOTOGRAPHIC HELIOGRAPH.

BY JACQUES BOYER.

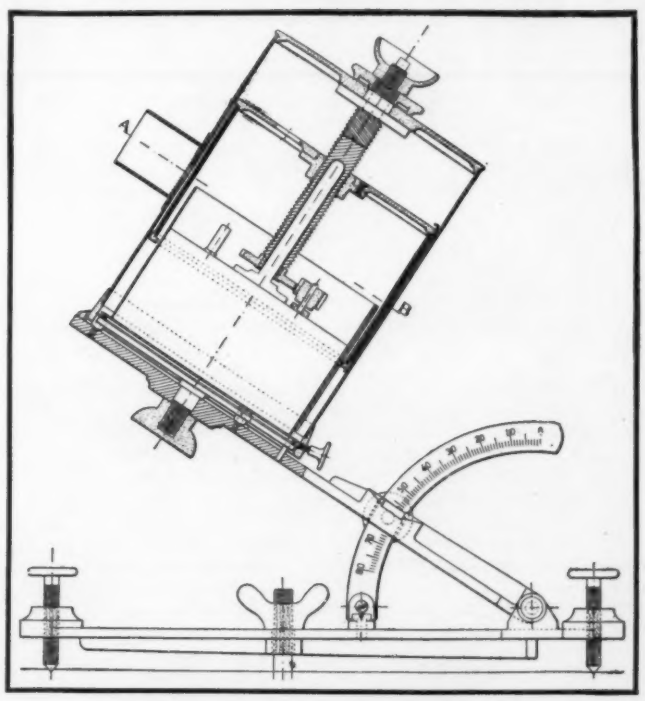
Bouguer, in order to measure the luminosity of the sun's disk, allowed a beam of sunlight to enter a dark room through a small aperture, behind which a converging lens was placed. The diverging cone of rays, beyond the focus of the lens, was intercepted by a screen, forming a circle, the brightness of which was not too great to be measured by the ordinary methods. The brightness of the sun was assumed to bear the same ratio to that of the circle on the screen that the area of the circle bore to that of the aperture through which the light entered. At a later date (1844) Fizeau and Foucault employed the photographic process which had just been discovered by Daguerre to compare the brightness of the sun with that of artificial sources of light. The quantity of light received by a unit of area of the solar image formed at the focus of a telescope is proportional to the clear aperture of the object glass. Fizeau and Foucault received the image of the sun on an iodized plate of silver. In successive experiments they varied the aperture of the objective and regulated the duration of the exposure so that the final tint assumed by the plate and, therefore, the quantity of silver iodide decomposed, was the same in each case. In this way they proved that the required length of exposure, within certain limits, varied inversely in proportion to the aperture of the objective. In other words, the total chemical effect was found to be (within the range of exposure) proportional to the total quantity of light received by the image during the exposure. Then, by comparing the image of the sun with that of a circular area, of the same apparent diameter, of the positive carbon of an electric lamp, they proved that the chemical effect is proportional to the brightness of the source of light. This relation, however, did not appear to extend indefinitely, for the quantity of silver reduced, which was at first proportional to the length of the exposure, tended toward a fixed limit when the exposure was greatly prolonged.

In 1881 the great advance which had been made in photography enabled Janssen to employ very sensitive plates, in which the total chemical effect remained proportional to the duration of exposure within very wide limits. Jordan devised a heliograph in the form of a perforated cylindrical box containing a sheet of ferroprussiate paper, and Richard constructed another instrument based on the photographic action of the solar rays.

Campbell, on the other hand, made use of the heating effect of the solar rays for the purpose of measuring the effective annual duration of sunlight, i. e., the aggregate time during which the sun is not veiled by clouds, a quantity which plays an important part in the processes of vegetation. Campbell's heliograph consists of a sphere of glass, mounted on a horizontal base, in a place exposed on every side, so that the sun is visible from its rising until its setting. A groove in the spherical mounting allows the introduction of a strip of cardboard, which forms a circular arc at such a distance from the spherical glass lens that the image of the sun, formed by the lens, is always on the strip. The cardboard is carbonized by the concentrated solar rays at the spot where the image is formed and, owing to apparent diurnal motion of the sun, a black line is traced on the card. If the sun shines all day without intermission this line is continuous, but if the solar rays are intercepted by fleeting clouds the trace consists of a number of separate portions, the positions and lengths of which show when and how long the sun has shone. The apparatus is easily set up. It is necessary only to level the base, to place the noon line, marked XII on the card, opposite a fixed mark on the frame, and to set the instrument so that the sun's image falls exactly on this line at the instant of true noon. In the improved form of the instrument designed by Stokes, the frame has three grooves, at different heights, in which three sorts of cards are placed. The shortest cards are placed in the highest groove and are used between November 5th and February 5th, the longest cards are placed in the lowest groove and are used between May 5th and August 5th, while the cards of intermediate length are placed in the middle groove and are used during the remainder of the year.



THE EIFFEL PHOTOGRAPHIC HELIOGRAPH.



VERTICAL SECTION OF THE EIFFEL HELIOGRAPH.

Eiffel has recently invented a photographic recording heliograph which has been used for some time at the central meteorological bureau of France and at the Juvisy observatory. It consists of a cylinder, which is mounted on a shaft parallel to the earth's axis, and is turned by clockwork at the rate of one revolution in twenty-four hours. The sun's rays enter the cylinder through an aperature in its convex surface, which is surrounded by a hood for the exclusion of diffused light. An inner cylinder, covered with photographic paper, is supported by a nut which can move along the shaft of the outer cylinder, which shaft bears a screw-thread. A guide, attached to the case of the clockwork, prevents the inner cylinder from rotating. Hence, as the outer cylinder turns, the inner cylinder is compelled, by the screw, nut and guide to move along the shaft, without rotating. The photographic paper is surrounded by a screen, which has various degrees of transparency in its various parts, corresponding to the average intensity of sunlight at different hours and seasons. As the outer cylinder rotates, its aperture is always directed approximately toward the sun and, in consequence of the motions of the two cylinders, the entering pencil of light traces a helicordal line on the paper, which is wide enough to serve for a number of days. No new conclusions can be drawn from the photographic records made by the Eiffel heliograph until after the instrument has been in continuous operation for several years.

CARDIN PROCESS OF PHOTO-SCULPTURE.

The idea of employing photography as an aid to sculpture soon followed the invention of the daguerreotype. Fifty years ago, Willème devised a process in which the sculptor's model was photographed simultaneously by twenty-four

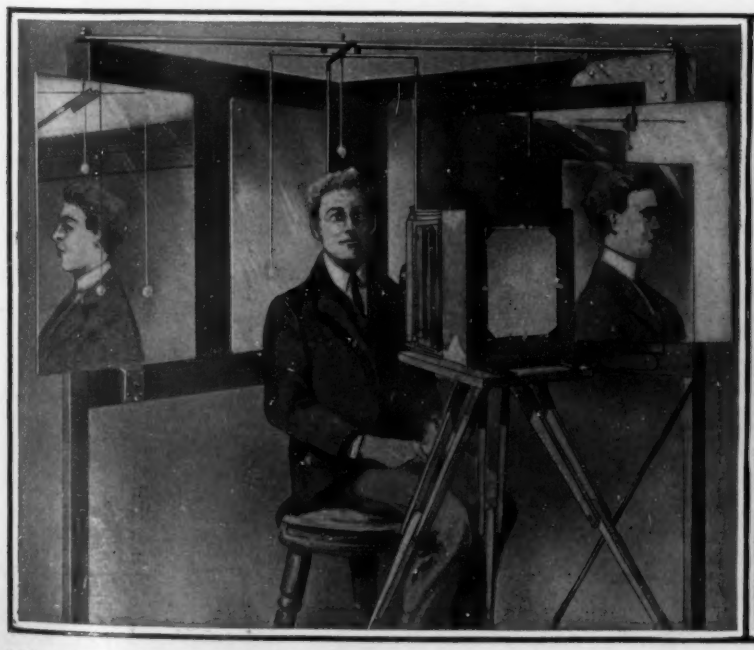


Fig. 2.—Cardin's apparatus for photographing the sitter from the front, back, and both sides simultaneously with a single camera.

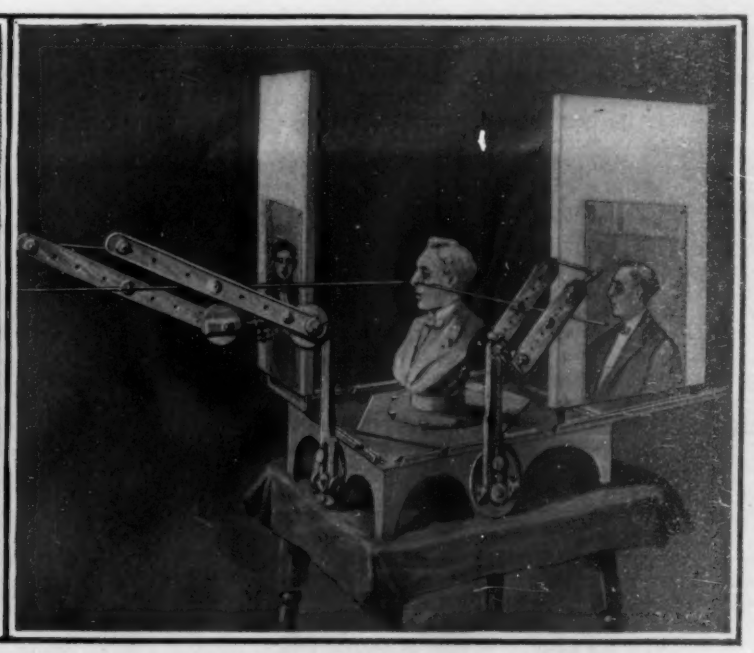


Fig. 1.—Cardin's apparatus for modeling from four photographs.

THE CARDIN PROCESS OF PHOTO-SCULPTURE.

cameras, arranged in a semicircle. A paper positive is made from each of the negatives and the twenty-four prints are cut out along the outline of the figure, and are then cut in two vertically. The forty-eight profiles thus obtained are assembled radially about a vertical axis in their proper relative positions. By filling in the intervals with a plastic mass a fairly complete sketch of the figure is obtained.

This process may be varied as follows: A mass of clay or modeling wax is placed on a revolving circular platform, the circumference of which is divided into twenty-four equal parts. The approximate form of the model having been given to the mass by the usual methods, the outline of the figure in one of the (entire) photographs is followed with the tracing point of a pantograph, which is so constructed and arranged that its copying point plows a furrow in the mass of clay. The platform is then turned through one division, and a second furrow is made from the second photograph. This process is repeated with each of the twenty-four photographs, and the clay between the furrows is carefully removed. A very skillful hand is required to perform this operation so as to reproduce every detail of the model, but the object of this and all other processes of photo-sculpture is to produce, not a finished statue or bust, but a sketch as nearly accurate as possible.

The new Cardin process possesses the advantage of requiring only one photographic camera. Fig. 2 illustrates the method of making the photographs required for a portrait bust. The sitter is posed, facing the camera, before a triple mirror, by means of which the back and sides of the head are photographed by reflection. As the sitter's face and the three virtual images formed by the mirrors are unequally distant from the lens, the four images formed by the latter are not in sharp focus in the same plane. For this reason the ground glass focusing screen is made in four sections, and the plate holder is contrived to hold four plates, side by side, but in slightly different planes. The same cause produces differences in the scales of the four photographs, but in making the enlarged copies which are employed in the operation of modeling, these differences are easily removed with the aid of the plummets which are suspended above and at each side of the sitter's head, and which appear in each photograph and indicate its scale.

The modeling apparatus is shown in Fig. 1. A vertical post rises from the center of the square iron platform *S*. Two photographs, a front view *T* and a profile *E*, are supported in a vertical position by frames which slide in guides bordering two adjacent sides of the table. These sides are furnished with jointed supports, which carry long rods, *A* and *B*. The rods can slide lengthwise in their supports and can be inclined and moved vertically and horizontally by means of the joints of the supports. The rods are used horizontally if the bust is to have the same scale as the photographs, and are inclined for enlargements and reductions. The movement of the photograph frames in the guides is limited by fixed stops, so that the frames can be removed and replaced exactly in their former positions.

The rods and their supports are adjusted to bring the inner end of the rod *A* into contact with a conspicuous point, the tip of the nose, for example, in the full face photograph *T*, and the inner end of *B* into contact with the corresponding point of the profile *E*. The frames containing the photographs are then removed and the rods *A* and *B* are pushed inward in their supports until their inner ends meet. The point of meeting determines the position of the top of the nose of the bust. The post at the center of the table is covered with clay or other plastic material, which is built out until this point is established in tangible form. The rods are then drawn back, the photographs replaced and a second point of the face is established by a repetition of the process. In this way numerous points distributed over every part of the bust are fixed, each pair of adjacent sides of the table, and the corresponding pair of photographs, being employed, as required. The result is an almost complete sketch, obtained from a sitting of a few seconds. All of these operations can be performed by a skilled workman. The hand of the sculptor is called into requisition only to give a few finishing touches, in another brief sitting, and to impress an individual artistic character upon the work.

HALLEY'S COMET IN THE EVENING SKY.

BY HENRY NORRIS RUSSELL, PH.D.

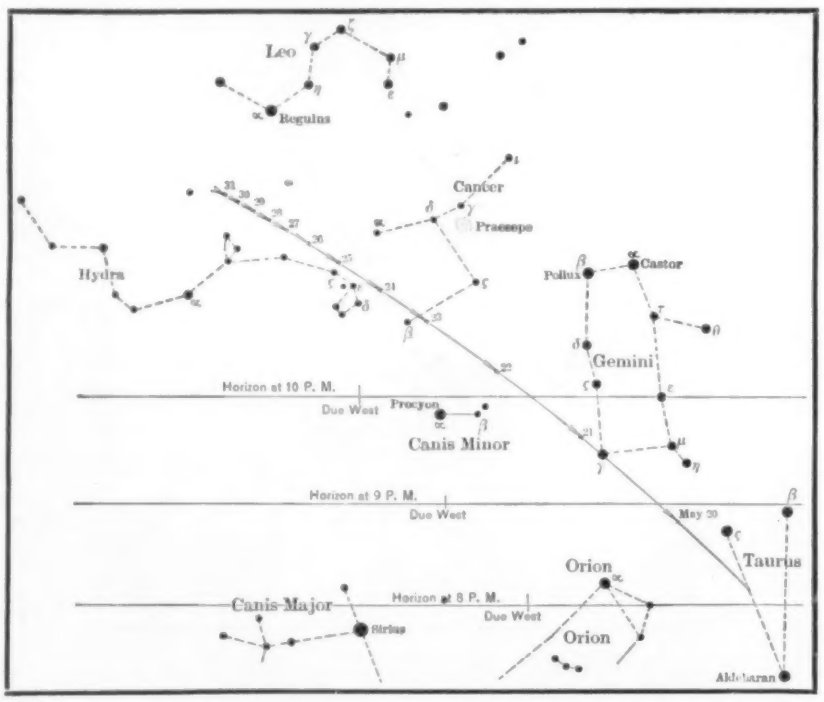
The average man will find by far his best opportunity to see the comet, which has occupied so prominent a place in public attention, during the last ten days of May. The accompanying map shows at a glance just what are the circumstances of its appearance. At first its apparent motion among the stars is very rapid, but later, as it recedes from us, it seems to stand almost still in the sky. Its distance from the earth is in round numbers 14 million miles on the 20th, 17 million on the 22nd, 28 million on the 26th, and 45 million on the 31st, so that it will appear to shrink and grow visibly fainter from night to night.

In addition to the stars near the comet's path, and the place of the comet for each night (at 10 P. M. Eastern Standard Time, or 9 P. M. Central Standard Time, etc.), the map shows the position of the horizon among the stars at certain hours, so that it is easy to estimate how high up they will appear at any time.

The given position of the horizon is exact for observers in latitude 40 deg. north (Pennsylvania, Ohio, Illinois, Utah, northern California).

Those south of this line will see the stars on the right (on the map or in the sky) somewhat lower, and those on the left somewhat higher, at the same hour. In any case it will be easy to identify them by their relative positions.

Those unfamiliar with the constellations may well begin with the four brightest stars: Regulus (at the end of the sickle-shaped group shown on the map), Castor and Pollux (close together), and Procyon (lower down, between these and Regulus). With these as guides, the other stars can readily be picked out, and the comet identified.



TRACK OF HALLEY'S COMET AND NEIGHBORING STARS, MAY 20-31, 1910.

From present indications it is probable that at first (on the 20th and 21st) the comet will be as bright as these bright stars and visible at a glance. Toward the end of the month it will be much fainter, but probably still easily visible to the naked eye.

The tail will extend upward and to the left, practically along the line of the comet's apparent path. How long it will be it is even yet impossible to say. At first the light of the moon (which is full on the night of the 23rd) will drown out the fainter parts of the tail, but later, when it is out of the way, these may perhaps be seen, though the comet will be so much farther off that, on the whole, it will hardly be so fine a sight.

In observing it telescopically, the eyepiece of lowest power, giving the largest field of view, will be most satisfactory.

Princeton University Observatory.

The Elasticity of the Earth.

Some interesting experiments have recently been carried out by Prof. Milne, F.R.S., the well-known authority on seismology, to demonstrate the elasticity of the earth especially under the influence of the tides. Some years ago he showed that valleys during the day are of greater width than at night, there being an expansion or opening out under the action of the sun and a contraction or closing up in the hours of darkness. He also showed by means of seismographic records secured at his observatory at Shide, that the Isle of Wight alternately moves forward and backward with the variation of the tides, the greater pressure of the water at high tide in the English Channel as compared with that in the Solent and Spithead causing the island to be tilted upward bodily from the channel side.

His latest experiments in this direction have been carried out in connection with the Irish Sea at the mouth of the Mersey. A special type of seismic recorder has been devised and has been set up in an underground position at Bidston Observatory near Liverpool, some two miles from the water's edge. The apparatus comprises, as it were, a mast and a boom, such as is used in the professor's earthquake recorders, the boom being free, so that as the mast moves in one direction or another the boom can also move. A photographic recorder is connected to the apparatus so as to secure a permanent visual record of the oscillations. The instrument is far more sensitive than that employed for ordinary seismic operations, thereby indicating those very slight movements of the earth which the ordinary apparatus would ignore.

The records secured by this instrument conclusively prove that twice every twenty-four hours the opposite sides of the tidal basin are drawn closer together, the phenomena occurring at high tide when the increased volume and weight of water piled up in the Irish Sea and pressing on its bed causes the latter to sag somewhat. The action can be watched, for when the tide is flowing quickly and the tide is high the pendulum moves a considerable distance and keeps pace with the deflection due to the increasing load. At Bidston the weight of the tide off the mouth of the Mersey causes a deflection of about one inch in a distance of sixteen miles. As the tide ebbs and the weight is reduced the sag diminishes like a dent in an India rubber ball, and the banks on either side slowly recede from one another. The extent of this attracting and repelling movement would be more accentuated upon the instrument were the latter placed nearer the sea, and Prof. Milne points out that for this reason observatories should not be situated too near tidewater. The regular alternate movements of the apparatus in opposite directions every six hours not only, as it were, record the extent of the elasticity of the earth's crust, demonstrating that it is responsive to pulls and strain to a far greater degree than is generally believed, but also weigh the tide itself. The result of these experiments should provide a new field for investigating tidal forces and phenomena, and possibly contribute to our knowledge thereof.

The Current Supplement.

Almost the entire issue of the current SUPPLEMENT, No. 1793, is devoted to a complete description of what is known as the New York Tunnel Extension of the Pennsylvania Railroad, the costliest improvement ever made by a railroad, and one of the most far-reaching importance to industry and to the traveler. Many pictures are published, showing the excavations which were made, the progress of the work, as well as the completed station. Dr. Otto Hoffmann writes interestingly on the system of the universe. Carbon tetrachloride possesses in comparison with carbon disulphide, benzine, gasoline, and other petroleum products used for the extraction of oils and fats, the advantage of freedom from inflammability, which reduces the danger of fire and the cost of insurance. Hence it is used frequently as a harmless substitute for benzine and gasoline in cleaning clothes. An article on the subject appears in the SUPPLEMENT. Mr. Henry A. Wise Wood's excellent paper on Modern Stereotypy is concluded.

Recently Mr. W. Casmey, of Leeds, read a paper before the Rotherham Engineering Society on "Engineering in the Boiler House." Mr. Casmey stated that there was an indication that the factory chimney would be supplanted by mechanical drafts or fans, as the cost of maintaining steam by such methods was only about one-sixth that of chimney draft. He pointed out that while steam gages and water indicators had long been in use, stokers had no assistance in ascertaining the volume of air necessary for combustion. A full combination indicator had, however, been invented for this purpose, consisting of a gage actuated by the draft of the chimney and having a graduated scale giving the pounds weight of coal burned to the square foot of grate per hour.

Wireless Telegraph Apparatus for Contestants of the Glidden Tour

BY RENÉ HOMER

In the district selected for the annual Glidden tour this year, ordinary telegraph communication will be very difficult, and at times impossible. In 1909, although the tour passed through a comparatively well-settled country, the whereabouts of several of the contestants were often unknown for hours. One car, for instance, failed to report at the night control, and no one knew what had happened until the next morning. On another occasion a passenger was injured in an

Bamboo aerial set up in car.

accident, and nothing was known of the matter until it was reported by a belated tourist at the night checking-in. Many minor difficulties were responsible for considerable delay that could have been prevented if the cars had been in communication with the last control.

The Chalmers-Detroit Company propose to keep in touch with the contestants by means of wireless telegraphy. Complete plans have not been worked out yet, but it seems probable that some such scheme as the use of three field wireless stations will be favored, two of the stations carrying on communication, one of them being in touch with the wire system, while the third station is being established at some advantageous point ahead of the contestants. The exact details of the plan will be furnished after a trial car has had a chance to go over the worst portions of the proposed route.

In the early part of March successful wireless telegraph tests were made for the Chalmers-Detroit Company between one of its cars in Central Park, New York, and the old Terminal Building at Park Avenue and 42nd Street. The distance varied from one and one-half to three miles in the trial from a moving car, while the experiments with the portable field stations showed that this type of apparatus at least would be able to carry on certain communication up to fifty miles, as the field station was able to keep in communication without any trouble with the Metropolitan and Manhattan Life towers and another wireless station at Newark, N. J. Later, communication was maintained between a car on the New Jersey highways near Trenton to the "sparkless" wireless station on the Land Title Building at Philadelphia, nearly thirty miles away.

The receiving station for running automobiles comprised a 7-foot aerial in connection, through a loose coupling, with a variable and a fixed condenser, a detector of the audion type, telephone receivers, and a high and low voltage battery. The sending set comprised two storage cells, a 10-inch spark coil, two Leyden jars, and a 3½-inch "radiotone discharger," similar to those used at the Metropolitan and Manhattan Life stations. This apparatus, which worked successfully up to three miles, the farthest distance tried, would probably operate for several miles farther. The ground was secured by drawing between the rear wheels a bicycle tubing frame supported on four small wheels mounted on roller bearings, the middle space being occupied by three 8-inch steel wheels with slide bearings arranged so as to allow the weight of the wheels to keep them in contact at all times with the road. On the macadamized roads of the park this system of grounding worked fairly well, although on the sandy roads of New Jersey, where the subsequent tests were made, a great deal of difficulty was experienced in properly maintaining the ground. The spraying of water over the contact wheels by means of a small rubber tube leading up into the car partially overcame this trouble, and no doubt subsequent experiments will provide a suitable way of securing a satisfactory ground contact, although it is true that probably for some time to come the speed of moving cars must be considerably limited for successful wireless work. The cars in the tests ran only about ten miles an hour.

Field stations which can be put up in five minutes can be operated more successfully, and the same apparatus used in the automobile by stopping the machine and securing proper ground has a range of about ten miles. The sending circuit of the field stations used in the longer distance tests was the same as that of the moving stations, with the exception that three storage cells instead of two were used, and another 10-inch spark coil was connected in parallel with the first coil, so as to be operated from the same key. This gave a range of about fifty miles.

The field sending station was provided with a 100-foot aerial secured at one end to a spreader attached to a 48-foot bamboo telescope mast and leading down diagonally to the top of a 12-foot mast about 90 feet away and thence back to the wireless apparatus about midway between the two poles.

Two of the photographs show the first successful test, in which a 35-foot aerial and a 6-inch spark coil actuated by one storage cell were used. With this apparatus, from Central Park, communication could be held with the laboratory at 42nd Street, about one and one-half to two miles away.

In the more recent tests additional condensers, storage cells, and audion receiving accessories were used. The closer view shows a radion detector in use (top of the box to left) while a perikon detector is shown unconnected on the table in front of the other apparatus. The box upon which the operator is sitting contains the interrupter, spark coil, and discharger, which are inclosed on account of their delicate nature and because they have not yet been protected by patent. In the newer station all this apparatus is carried in the automobile, and there is no necessity for setting up the apparatus on the ground, although the soap box does indeed make an admirable table for a wireless station.

In the coming tour it is proposed to send two scout

Automobile wireless equipment.

cars ahead of the regular contestants, each one of which will carry the complete field set of even greater range than that which every car can carry. Points where the telegraphic facilities are poor or impossible will be picked out, and the two cars will arrange to be at stations at these points just ahead of the pilot car, one station being equipped for business while the other is taking care of the telegraphic business of the tour. In this way one of the two field stations will be in operation all the time, while the other is being set up at the next point along the route.

Disastrous as the floods in France have proved for the railways, a worse disaster occurred one day last winter in America. Three days previously a warm wind arose in the State of Nevada, so suddenly as to melt all the snow. The result was such a torrent as to entirely wash away 100 miles of the San Pedro, Los Angeles and Salt Lake line south of Caliente. The route of this line was known to be rather liable to this, but was chosen as it saved much distance. Soon after its construction it was undermined by a storm, which did over $500,000 damage to it. The engineers are now engaged in surveying the district in order to find a safer if longer and most costly route. Whichever route be chosen, it will be from six months to a year before the line can be built, and the cost will, it is said, be from ten to fifteen million dollars.

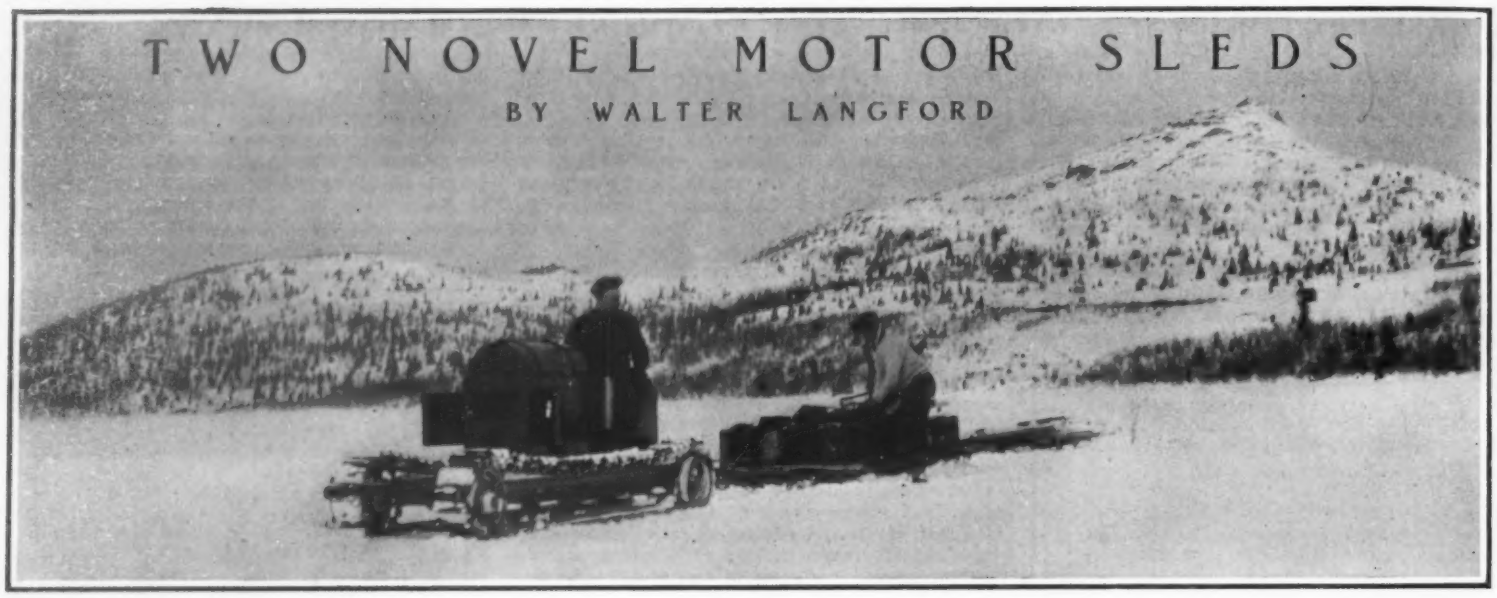
The automobile equipment with its aerial and wireless apparatus.

Sending wireless messages from an automobile.

WIRELESS TELEGRAPH APPARATUS FOR CONTESTANTS OF THE GLIDDEN TOUR.

TWO NOVEL MOTOR SLEDS

BY WALTER LANGFORD

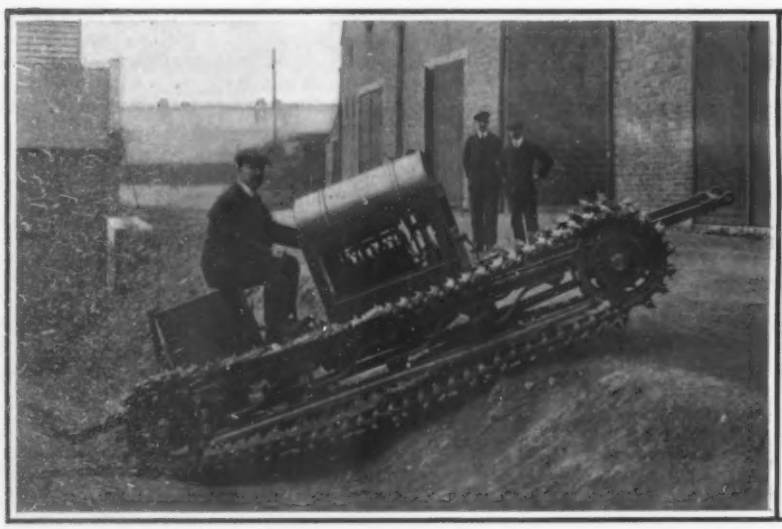


The practical success achieved with the gasoline-propelled motor sleighs on the Shackleton and Charcot polar expeditions has prompted Capt. Scott to include a vehicle of this type for his forthcoming dash to the south pole. This vehicle is, however, distinctly different from the motor sleighs hitherto used. In the two previous cases the front of the car was mounted on runners or skates, a chain and sprocket with spuds which gripped the snow and ice being fitted at the position occupied by the wheels in the ordinary motor car. In the new sleigh, however, what may be termed an adaptation of the pedrail or caterpillar system has been resorted to, which imparts a greater degree of efficiency to the vehicle, and enables it to surmount obstacles and to travel over rough ice and snow with ease. In view of the conditions prevailing and the work it is intended to fulfill in the south polar regions, the engine is of a special type. It comprises four vertical cylinders, cast in pairs, and developing twelve brake horse-power.

The sleigh is fitted with a runner, upon which bear the rollers of the chain. The latter passing between this runner and the ground supports the whole vehicle and propels it as the wheels revolve. There are no brakes provided, as the big reduction ratio of the worm renders it completely irreversible, so that brakes are not necessary. Similarly, steering gear is dispensed with, as such is not requisite, for in any open area such as an ice field steering is not demanded. When it is required to deviate to the right or left, ropes attached to the front of the frame can perform this function. Turning sharp corners, under these circumstances, is admittedly exceedingly difficult, but when working in its designed sphere this drawback will not be serious, as sharp turning can be generally avoided.

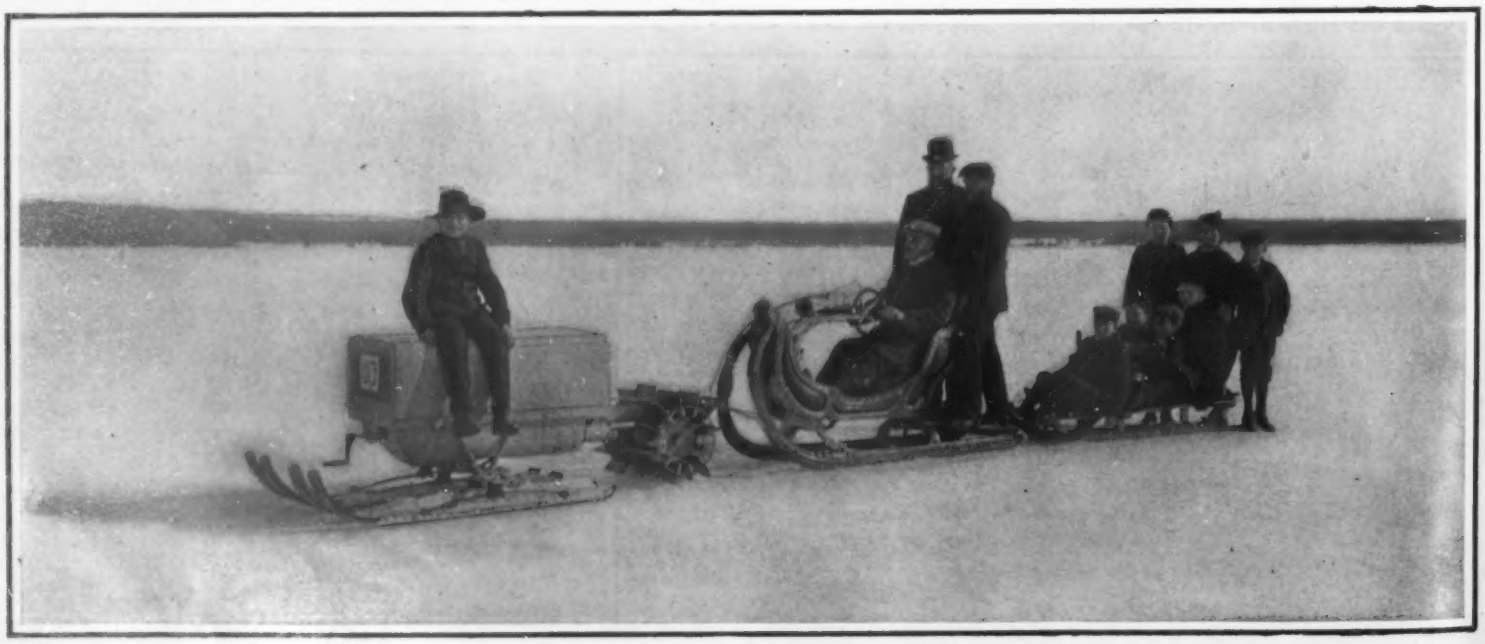
The sleigh has a substantial wooden frame, and underneath is fitted a large undershield extending from end to end so as to present a perfectly smooth surface to the snow. When the sleigh is under way a curious fact is observable. The chain, where it

(*Concluded on page 407.*)



Pedrail motor sled which Capt. Scott will use on his forthcoming antarctic expedition.

Capt. Scott's traction sled undergoing its tests in Norway.



A Swedish motor traction sled with a maximum speed of 24 miles an hour.

TWO NOVEL MOTOR SLEDS.

THE FLIGHT FROM LONDON TO MANCHESTER

THE AVIATORS' OWN ACCOUNTS

Both White and Paulhan have furnished the London Daily Mail with accounts of their remarkable flights.

White rose at 2.30 A. M. Twenty-four minutes later he was in the air. It was so dark that people were groping about with lanterns.

"As I stood by the side of my aeroplane," White states, "there was utter blackness facing me, faintly relieved in the distance by two or three twinkling lights, which I knew to be those of Roade station.

"My start was a confused jumble of scattering lights, which swept away swiftly below me. I could not judge my run along the ground, but I rose as speedily as possible. Directly I was in the air the lights of the railway station showed clearly below me, and I headed toward them. I could see absolutely nothing of the ground below me; it was all a black smudge.

"I went right over the railway station lights and then, fortunately only for a second or so, my engine missed fire and I began to sink toward the inky darkness below me. I could have picked no landing, and it would have been a swift, steep glide to I know not what. And then, to my joy, my engine picked up again and I rose once more.

"Great difficulty presented itself in knowing in the darkness whether I was ascending or not. I had done no night flying before, but I soon became accustomed to watching closely the movements of my elevating plane, which was silhouetted before me against the sky.

"I steered on for a spell with nothing at all to guide me. After leaving the lights of Roade behind, the gleam from an occasional signal box far below helped me, however, and so I picked my way through the night to Blisworth.

"Here I felt surer of my ground and bore away to the left for Weedon. Faint lights shone here and there. Some, no doubt, were cottage windows and others, I think, were the head-lights of motor-cars. I passed over Weedon, my eyes becoming more accustomed to the darkness.

"On I flew. The weirdness of the sensation can scarcely be described. I was alone in the darkness, with the roar of my engine in my ears. As I glanced back small bright flashes of light, the discharge of the exhaust gases from the motor, flashed out in the night.

"Then I lost my way, with no railway lights to guide me, for a spell. I steered off to the right. I wheeled and turned, wondering what I should do, but then a light to my left caught my eye, and I worked my way back to the railway line again.

"At a little inn by the roadside near the village of Crick a friend had promised to draw up his motor car, shining its headlights upon the wall to act as a guide for me. I was keenly on the lookout for this unmistakable light sign, and, sure enough, I saw it quite distinctly below me soon after I left Welton station behind.

"I deviated a little from my course and headed for this patch of light. I saw the motor car moving as I approached, with its headlights throwing a great path of light down the roadway. It set off at a break-neck pace, its driver evidently meaning to guide me on my way.

"Leaving the railway line on my left, I followed the light of the motor car, and for a mile or so I hovered almost directly above it, allowing it to act as my pilot. But while I was doing so I chanced to glance over to the left again. Coming down the railway line I espied a goods train. It was making for Rugby.

"This, I thought, will be a splendid guide, and so I swung away from the lights of the motor car and flew off till I was over the train. I saw the lights of Rugby, flew over the town, and forged ahead.

"Daylight began to come now, and from here on to the point of my descent in a field near Polesworth my struggle was not with the darkness, but with the wind. It was the fierce gusts which eventually brought me down."

Paulhan, too, seems to have been troubled by the winds; for he bears out White's account. He writes:

"I had to fight the wind all the way from London. Not a moment's rest came to me in my battle against the gusts.

"Glance at my altitude chart and you will see that I made rises and dips of as much as 320 feet, always with the object of flying in the steadiest level of air I could find.

"After the start I was going north for a long time before I sighted the special train which was accompanying me, but there was no mistaking it when it caught me up, with three loud toots of the whistle and a big white signal cloth flowing from the window of the rear coach.

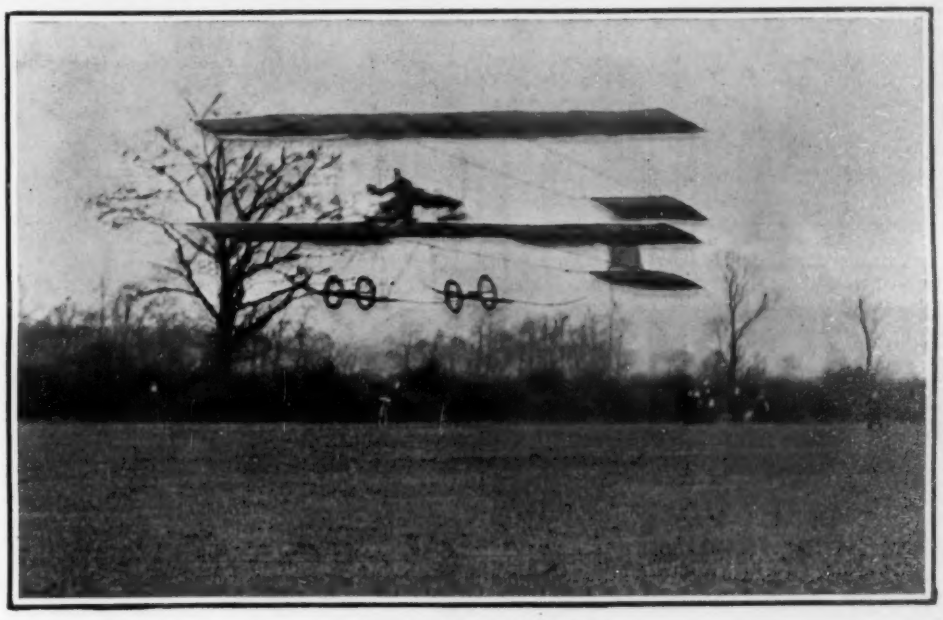
"It looked like a handkerchief from such a height, but it told me all. I could see that things were going well. The wind whistled and so did I.

"I flew until it was quite dark. All I could make out beneath me was the smoke of the train once in a while and the occasional flicker of lights from a village.

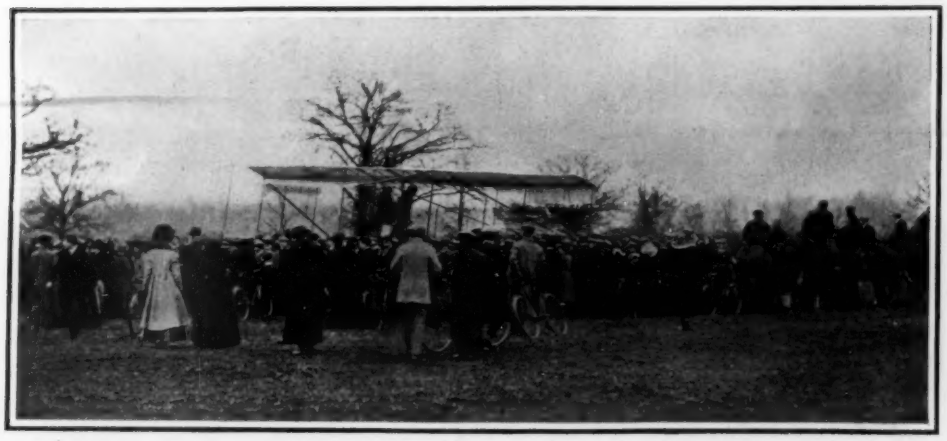
"I came down rapidly from 300 meters to 100, so that I could be more certain of my direction. Then came the most exciting moment of my flight. Darkness had fallen, and before me I saw the lights of Lichfield. I decided to alight in some convenient meadow before reaching the town, and to do this I sank down to 150 feet. I was immediately above what looked like a large factory with a chimney. I am now told it was a brewery. And so, to alight safely in a field with no damage done, I made a fishhook turn, and my machine was now pointing toward London.

"Suddenly my motor stopped. Every drop of petrol had been exhausted, and the machine swooped downward almost like a stone dropping.

"What should I do? Beneath me was the brewery



Grahame White leaving Rugby.



White's aeroplane after landing.

Recharging the gasoline tank of White's machine.

and a certain smash; behind me was a narrow field, which was almost like a spider's web with its mesh of telegraph wires.

"I had an imperceptible fraction of a second in which to make up my mind, and I decided to risk the telegraph wires. As I sank I made a sharp twist right back on the line of my course, and was lucky enough to lift myself over the wires.

"I went to bed at 1 o'clock, deciding to start again as soon as it was light, or even a little earlier. I slept like a top for five hours.

"It was still dark when I reached the narrow meadow beside the Trent Valley station in which my machine was lying. My mechanics had worked well during the night. The machine was charged with petrol and she was all ready for the start.

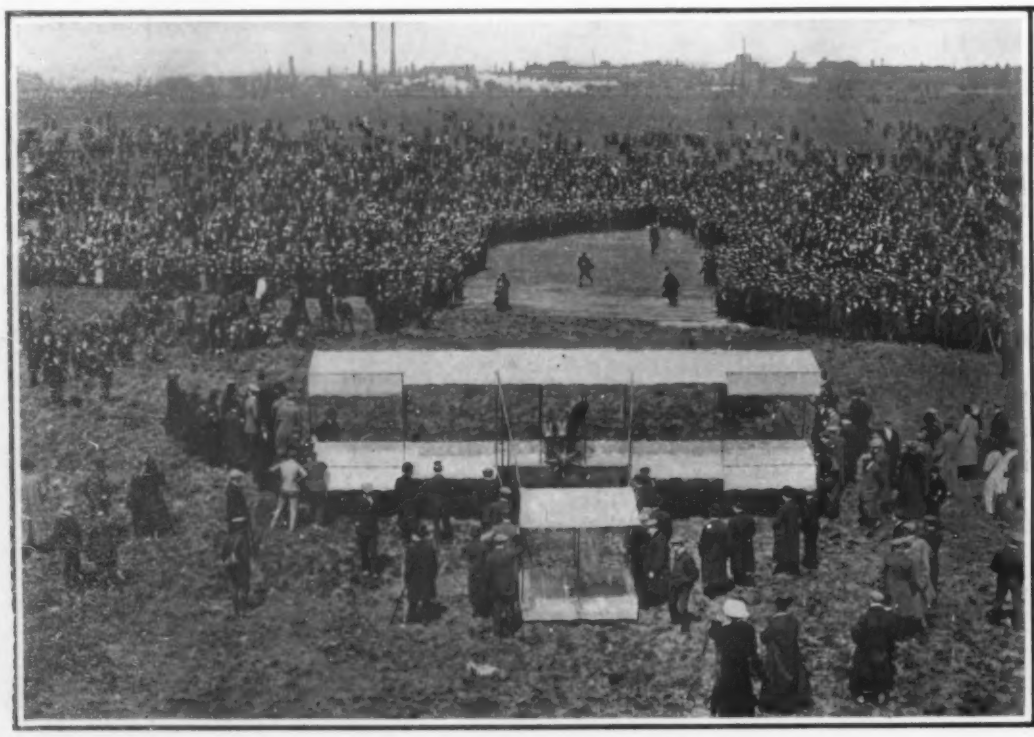
"Happily, favored with the headwind I was then facing, though it was a following wind for my flight, I rose without difficulty, turned, and headed straight for Manchester.

"Here was the end of my concern about the issue of the race. Barring accidents, I was bound now to reach Manchester in safety and in good time, and there was no reason to anticipate accident, for I had surmounted the worst of the difficulties—that of a rise from a narrow field only 120 yards long above dim lanterns which were my only indications as to the whereabouts of the hedge.

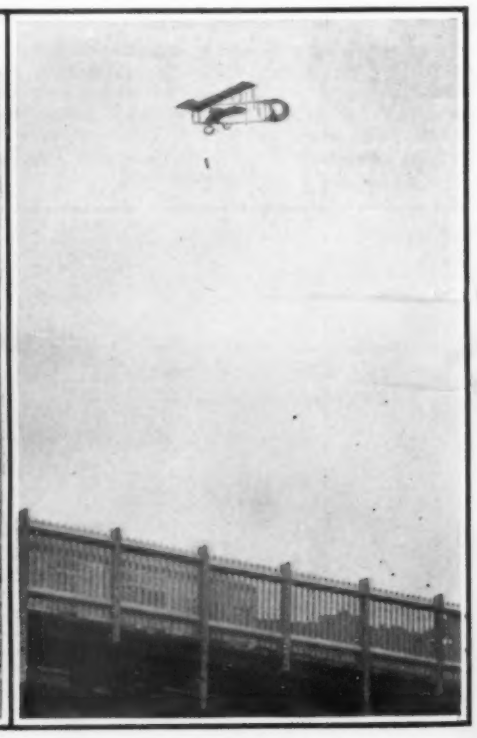
"As soon as I got up I made a circle, followed the railway, and then set off for Crewe, fighting all the way against gusts of wind. So certain did I feel of the road that I did not trouble to take my map on the second stage of the journey. This was a mistake, for after leaving Crewe I thought the first station marked my landing place, but I could discover none of the marks I expected to find there, and I had to circle back toward London before I picked up the whitewashed marks on sleepers which directed me onward.

"I made yet another mistake in my route, and had to curve in yet another circle backward, but at last I saw the new station at Burnage, which was my objective, and I saw the white marks in the field where I was to land.

"I landed, and I knew I had won. All the way from London it had been a fight between me and a puzzling wind, and I had beaten the wind."



The crowd on Wormwood Scrubbs awaiting White's start.



Paulhan in full flight.

THE FLIGHT FROM LONDON TO MANCHESTER.

Official Meteorological Summary, New York, N. Y., April, 1910.

Atmospheric pressure: Highest, 30.28; lowest, 29.57; mean, 29.93. Temperature: Highest, 79; date, 30th; lowest, 34; date, 8th; mean of warmest day, 64; date, 5th; coolest day, 41; date, 8th; mean of maximum for the month, 62.1; mean of minimum, 45.8; absolute mean, 54.0; normal, 48.1; daily excess compared with the mean of 40 years, 5.9. Warmest mean temperature of April, 54, in 1871 and 1910; coldest mean, 41, in 1874. Absolute maximum and minimum of April for 40 years, 90 and 20. Average daily excess since January 1st, 4.1. Precipitation: 4.53; greatest in 24 hours, 2.23; dates, 25th and 26th; average for April for 40 years, 3.30. Excess above normal, 1.23. Accumulated excess since January 1st, 0.14. Greatest precipitation, 7.02, 1874; least, 1.00, in 1881. Wind: Prevailing direction, northwest; total movement, 9,169 miles; average hourly velocity, 12.7; maximum velocity, 44 miles per hour. Weather: Clear days, 7; partly cloudy, 13; cloudy, 10; on which 0.01 or more of precipitation occurred, 11. Mean relative humidity, 68.1. Dense fog, 4th and 18th. Thunderstorms, 6th and 25th. Frosts: Light, 14th; heavy, 13th.

COMPLETION OF THE PENNSYLVANIA RAILROAD TUNNELS AND TERMINAL STATION.

As late as the year 1901 the Pennsylvania Railroad was employing ferries to land its passengers in New York city just as it did in 1871, when it first leased the United Railroads of New Jersey. Ten years ago the system was hauling freight to Eastern cities over practically the same heavy grades as were to be encountered in 1875. To-day the company is completing a monumental improvement in and around New York city which will enable passengers to travel from eastern, western and Long Island points direct into Manhattan Island, arriving at a railroad station which, for convenience and for the beauty and dignity of its architectural appearance, probably outranks any similar building in existence.

During the past ten years the company has spent an enormous sum of money in straightening out its line to the East, and in cutting down grades, and in a few months' time freight trains which are already traveling over the new lines, on which they encounter no grades greater than twelve feet to the mile, will be run direct to large terminal wharves on the New Jersey shore of upper New York Bay, and ferried across to Bay Ridge, Long Island. The company is about to construct a four-track arch bridge across the East River near Hell Gate, and when this is completed, trains will be run through Long Island from Bay Ridge to Port Morris, where connections will be made with the New York, New Haven and Hartford Railroad. Passengers from the South, Southwest, and West, over the Pennsylvania Railroad system, by using the North River and East River tunnels and the Hell Gate bridge, will be enabled to travel without change of cars between New England and the West by way of New York city. These stupendous works, which will have cost in the aggregate, including the revision of the western line, over $150,000,000, were conceived mainly during the administration of the late A. J. Cassatt, former president of the company.

Commencing at the western end of the New York tunnel system, we find at Harrison, New Jersey, a large terminal and transfer station, where passenger trains from the South and West drop their steam locomotives, and the electric locomotives, which haul them into New York city, are coupled on. The tracks run on a high embankment across the Hackensack meadows to Bergen Hill, where they enter the western portal of the twin tunnels. They descend on a grade of 1.3 per cent to a level about 100 feet below mean high water of the Hudson River, which level is reached about one-third of the distance from the Jersey shore. The line then rises on grades of 0.5 and 1.93 per cent, until the station yard is reached at Tenth Avenue. The yard and the station, which have been excavated to an average depth of fifty feet below the original street surface, extend from Tenth Avenue to Seventh Avenue. From Tenth to Ninth Avenues the yard occupies more than the area of a city block, and from Ninth Avenue to Seventh Avenue the huge excavation covers the whole width between Thirty-first and Thirty-third Streets. The excavation covers therefore over five of the largest city blocks, and it involved the removal of over 3,000,000 cubic yards of material. Proceeding easterly from the terminal yard, the tracks, four in number, are carried below Thirty-second and Thirty-third Streets to the East River, under which they pass in four separate tubes. The grade descending to the river is 1.5 per cent, and the ascending grades to Long Island are 0.7 and 1.22 per cent.

The new terminal station located between Thirty-first and Thirty-third Streets, and Seventh and Eighth Avenues, is a truly magnificent structure, built of granite on classical lines. The terminal work was carried out under Mr. George Gibbs as chief engineer, to whom we are indebted for courtesies during the preparation of the present article. The main entrance to the station, on Seventh Avenue, leads through an arcade forty-five feet wide by two hundred and twenty-five feet long, to the main waiting room, which, with its width of 103 feet and length of 277 feet, and clear height of 150 feet, ranks as the largest in the world. Just what these dimensions mean is shown by our front page engraving, which portrays the central portion of the New York City Hall with its tower, standing on the floor of the waiting room, with the top of its flag pole failing to reach the roof by fully ten feet. Opening out from this room are two smaller waiting rooms, each 58 by 100 feet, which are provided with the usual retiring rooms. On the same level also is the main baggage room, 450 feet in length. The baggage is brought in, and carried away, through a special subway, the trunks, etc., being delivered to the track below by motor trucks and elevators. Passing through the main waiting room, the traveler will find himself on a vast concourse 210 feet wide, which extends the full width of the station and parallel with the large waiting room. From the concourse, stairs lead down to the train platforms on the track level below, which is forty feet below the street surface. The concourse, which is 340 feet long, is covered by a lofty roof of light steel columns and arches and glass. Between the concourse and the tracks is a subconcourse, sixty feet in width, which will be used for outgoing passengers only.

The Thirty-third Street side of the station will be devoted to the Long Island Railroad service. It will be provided with its own entrances and exits, and the traffic will be handled independently of the western traffic.

In the design of the exterior of the station, the architects, McKim, Mead & White, endeavored to give to the building the character of a monumental entrance to the commercial metropolis of the country, which would at the same time conform to the traditional aspect of a great railway terminus. Also the station was designed to give as free a circulation as possible for the many millions that will annually pass through it. The main façade on Seventh Avenue is

composed of a Roman Doric colonnade, with columns four feet six inches in diameter and thirty-five feet high. Allowing for its much greater scale, the main entrance is comparable to the Brandenburg gate in Berlin. The main body of the building is about the same height as the Bourse of Paris, reaching, as it does, seventy-six feet above the street level. The main entrance on Thirty-second Street is at the center of this façade, and at each corner is a sixty-three-foot wide carriage drive, fronted by double columns and pediments. Midway along the Thirty-first and Thirty-third Street sides of the building are similar columns and entrances to that on Seventh Avenue.

The passenger station building, which is 784 feet long by 430 feet wide, covers some eight acres of ground, and the construction of the exterior walls, which are nearly half a mile in length, required nearly half a million cubic yards of pink granite. This and other stone work in the building ran up to a total of 47,000 tons, and to transport it from Milford, Mass., called for the service of 1,140 freights cars. Into the construction of the building there has also entered 27,000 tons of steel and 48,000 tons of brick.

The statistics of dimensions and quantities of material are of such interest that we present the following from among those supplied by the railway company:

Area (10th Avenue to normal tunnel section east of 7th Avenue)	28 acres
Length of trackage	16 miles
Number of standing tracks at station	21
Number of passenger platforms	11
Total excavation required	3,000,000 cubic yards
Length of retaining walls	7,800 feet
Number of lineal feet of streets and avenues carried on bridging	4,400, or an area of about 8 acres.
Concrete required for retaining walls, foundations, street bridging and substructures	160,000 cubic yards
Number of columns supporting station building	650
Greatest weight on one column	1,658 tons
Number of buildings removed on terminal area, about	500
Boiler capacity of service power plant, ultimate	5,000 horse-power
Total length of tunnel (2-track), Jersey to Long Island	5.3 miles

After passing under the East River the four tubes reach Sunnyside Yard, the terminus of the Long Island tunnel extension, which covers some 153 acres of land. It contains 73 miles of track, and has a capacity of 1,550 cars. From the Sunnyside yard there are tracks leading to the New York connecting railroad, which will form a junction with the New Haven Railroad at Port Morris.

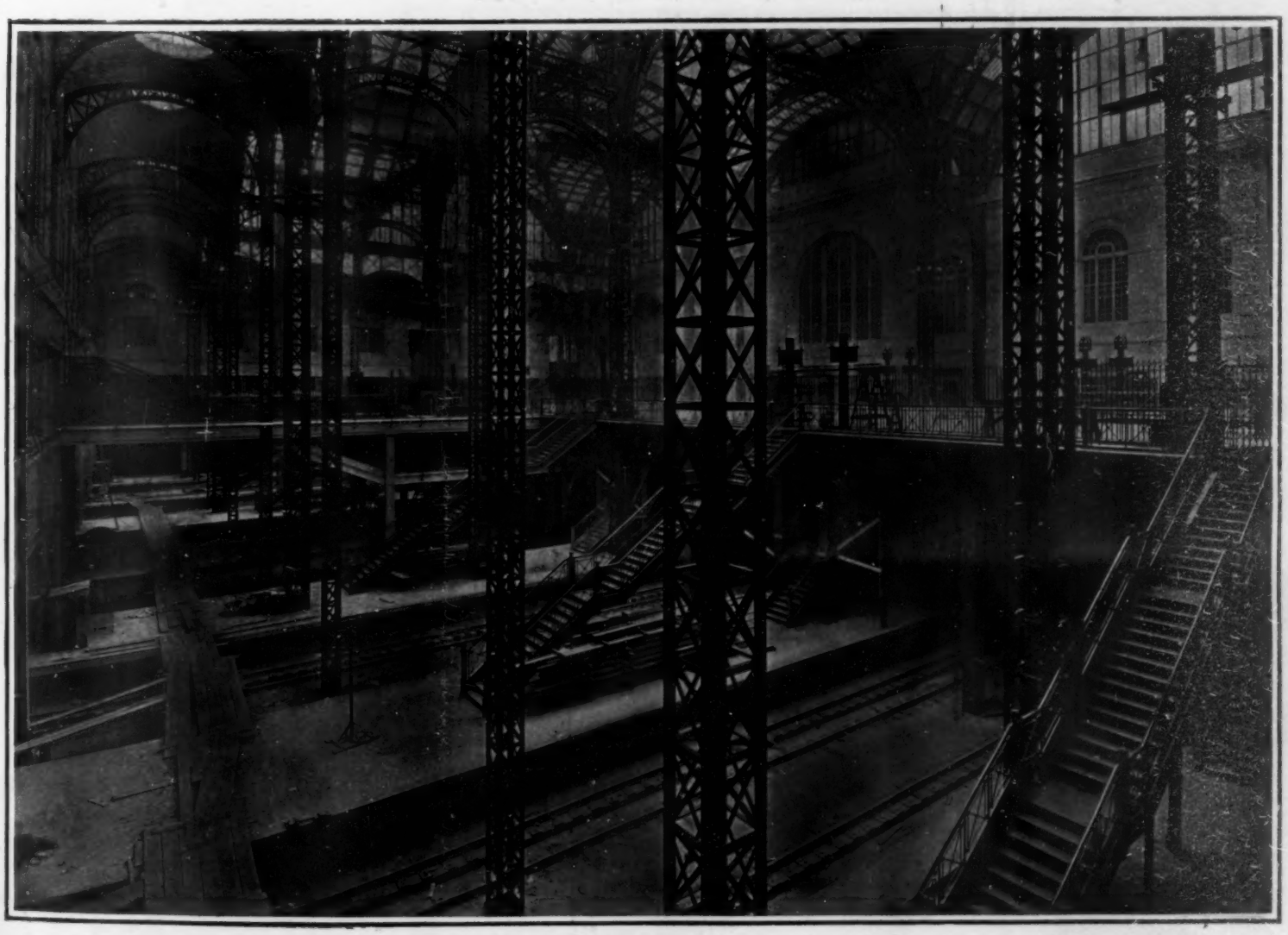
An important feature of the New York tunnel extension is its relation to the Long Island Railroad, which is subsidiary to the Pennsylvania system. It is estimated that forty minutes will be saved between Long Island points and New York city by the operation of trains through the East River tunnels to the Pennsylvania station at Thirty-third Street.

The construction of the tubes beneath the Hudson and the East rivers has been so fully described in previous issues that it will be sufficient here merely to recapitulate the principal features of this work. The tubes under the Hudson River were driven by a special shield designed by Charles M. Jacobs, who is also well known as the chief engineer of the four Hudson River tubes which were simultaneously being driven for the Hudson Company's system of rapid transit tunnels. Contract for the North River tunnels was let to the O'Rourke Engineering and Construction Company. The shields were thrust forward by twenty-four rams capable of exerting a pressure of 3,400 tons. At first, the silt and other material were removed through the doors in the front of the shield; latterly, however, the shields were pushed bodily through the material, and only about one-third of it was removed through the tunnel, being admitted through the doors in its lower face. The cast-iron lining of the tunnel is twenty-three feet interior diameter. The interior is lined with two feet of concrete, making the finished interior diameter of the tunnel nineteen feet. The weight of the cast-iron lining, with bolts, is from 9,609 to 12,127 pounds per linear foot of tunnel. The weight of the finished tunnel with the heavier lining, when concreted up and equipped, is 31,469 pounds per lineal foot. The weight of the silt displaced, per linear foot of tunnel, is 41,548 pounds. The weight of the tunnel with the maximum train load is 41,869 pounds per linear foot.

Thanks to the very able and efficient engineering staff, the excellence of the contractors' equipment, and the harmony with which all concerned entered into the task of driving these tunnels, the work was carried through practically without a hitch, and considerably faster than the most sanguine expectations. The driving of the tunnels beneath the East River, which was in charge of Alfred Noble, Past President of the American Society of Civil Engineers, was done by S. Pearson & Son, the contractors, of London. Because of the great variety and difficult nature of the material through which the tubes passed, much trouble was experienced at various times with blowouts; but ultimately these difficulties were mastered and the tubes pushed through to successful completion.

In addition to the many millions the Pennsylvania Railroad is spending on the four tunnels under the East River, and the station and terminal in Manhattan, all of which will greatly benefit Long Island, the Long Island Railroad is increasing its own facilities in all directions, so as to adequately care for the larger traffic which will result from the completion of the tunnels. The contemplated works will necessitate an expenditure on the Long Island system of more than thirty million dollars. The new service will include a six-track line from the mouth of the tunnels to Woodside, 2½ miles; one mile of 8-track road, Woodside to Winfield; two miles of 6-track road, Winfield to Glendale cut-off, and 4½ miles of 4-track road thence to Jamaica. Trains will run from Thirty-third Street, Manhattan, to Jamaica in 18 minutes; to Garden City in 34 minutes; to Mineola in 34 minutes; to Far Rockaway in 33 minutes; to Flushing in 16 minutes, and to Great Neck in 26 minutes.

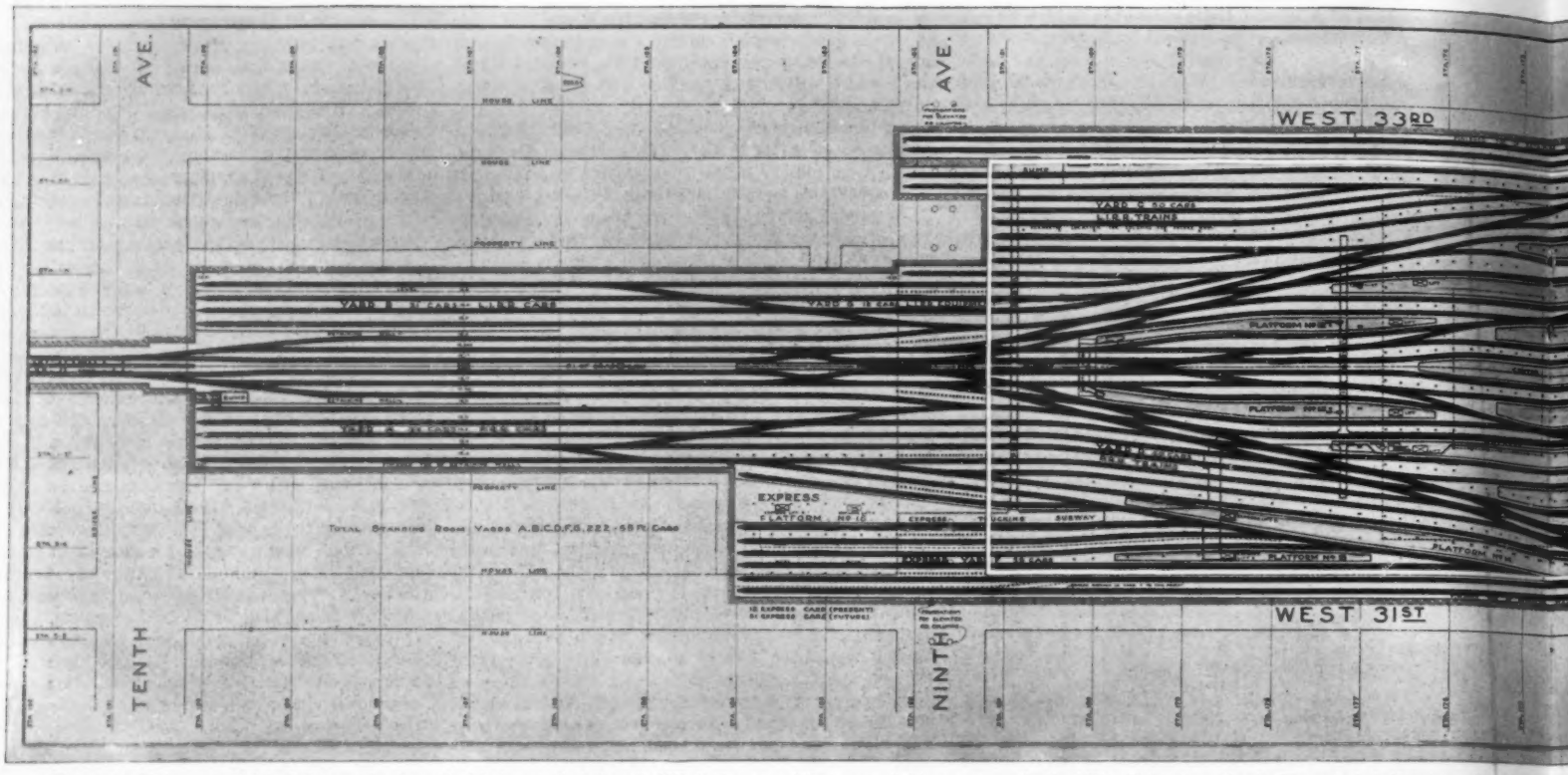
We will close by giving some of the startling statistics of population which in the judgment of the Pennsylvania Railroad Company fully warranted the enormous outlay involved in the great works which the company has undertaken. The population, included within a circle of nineteen miles drawn from the City Hall in Manhattan as a center, was in 1890 3,326,998; in 1900 it had increased to 4,612,153, and in 1905 it had grown to 5,404,638. It is estimated that by 1913 the population of this territory will be about 6,000,000 people, and in 1920, 8,000,000. The railroads that have their termini on the western bank of the Hudson River carried nearly 59,000,000 people in 1886. In 1890 they carried over 72,000,000; in 1896 more than 94,000,000, and in 1906 they carried about 140,000,000 people. The significance of these figures was fully considered by the Pennsylvania Railroad, and the vast works they have undertaken are thought to be fully justified by the present and prospective growth of travel within the areas affected.



From the waiting room (103 feet by 277 feet) the passengers enter the concourse (210 feet by 340 feet) from which they descend by stairways to the arrival and departure platforms below.

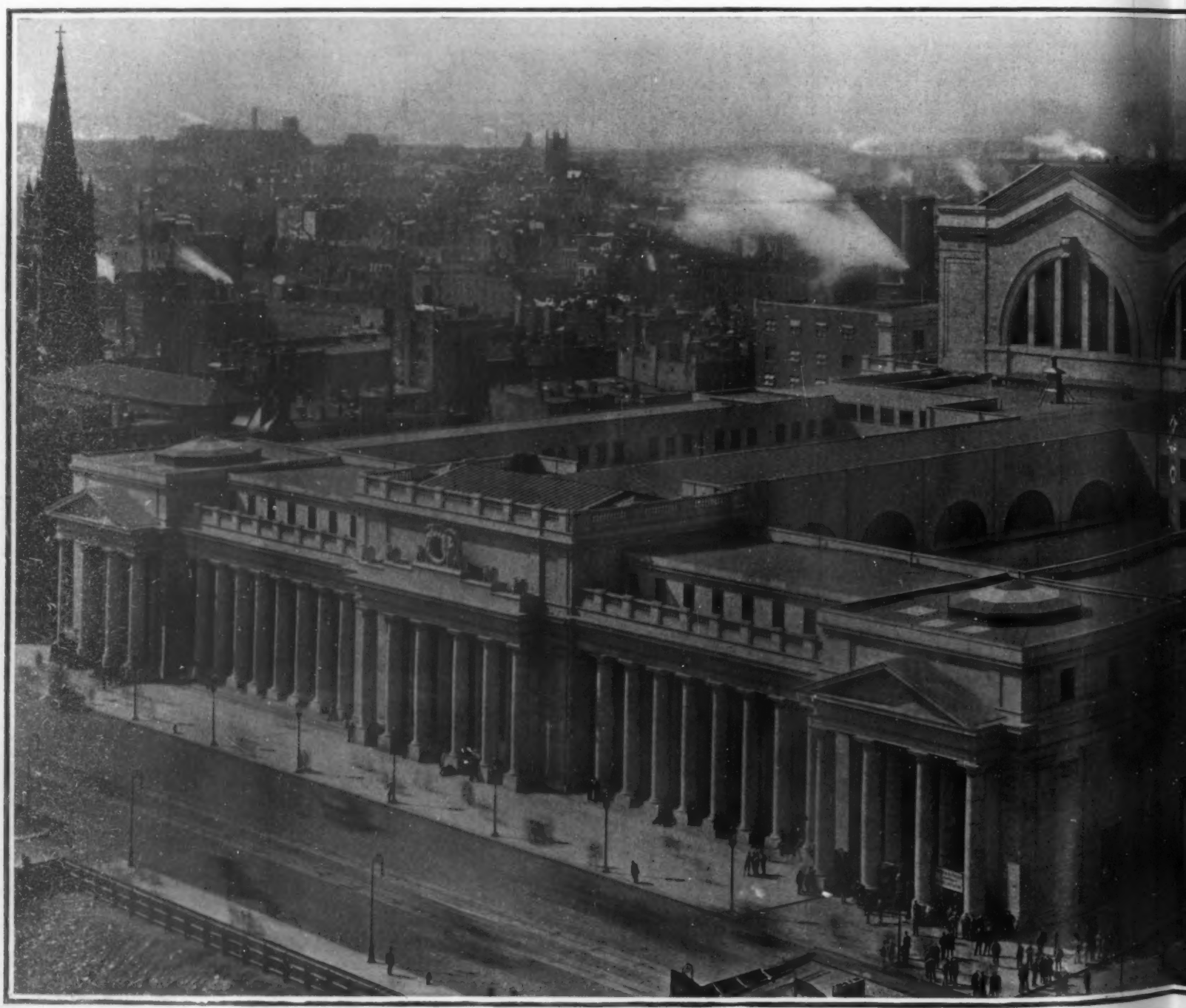
Interior view showing the concourse and the station platforms.

COMPLETION OF THE PENNSYLVANIA RAILROAD TUNNELS AND TERMINAL STATION.



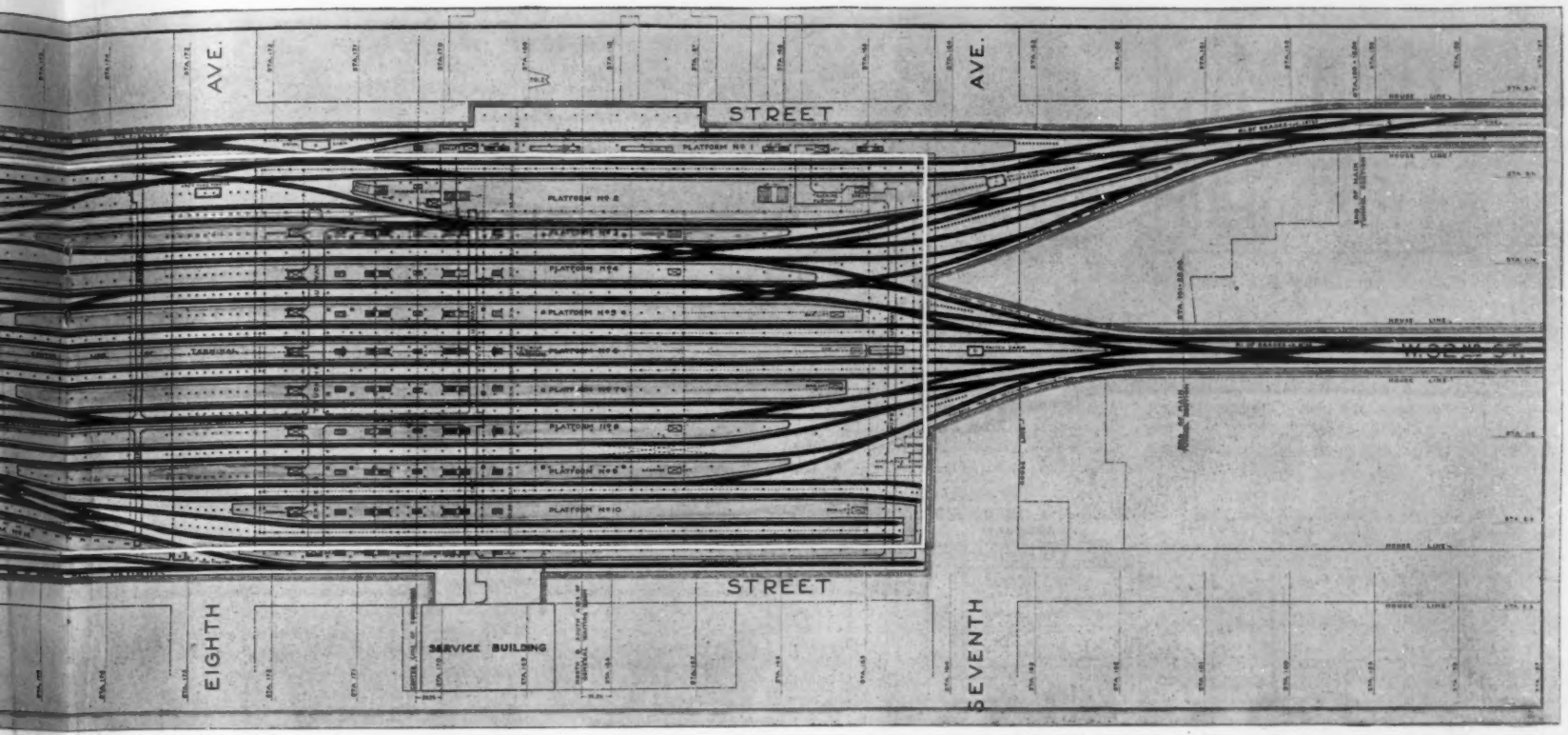
The whole of this area, which includes over five large city blocks was first cleared of 500 city houses and then excavated to an average depth of 50 feet below street level. The easterly half, between Seventh and Eigh

PLAN OF THE HUGE SUB-SURFACE STATION YARD OF T



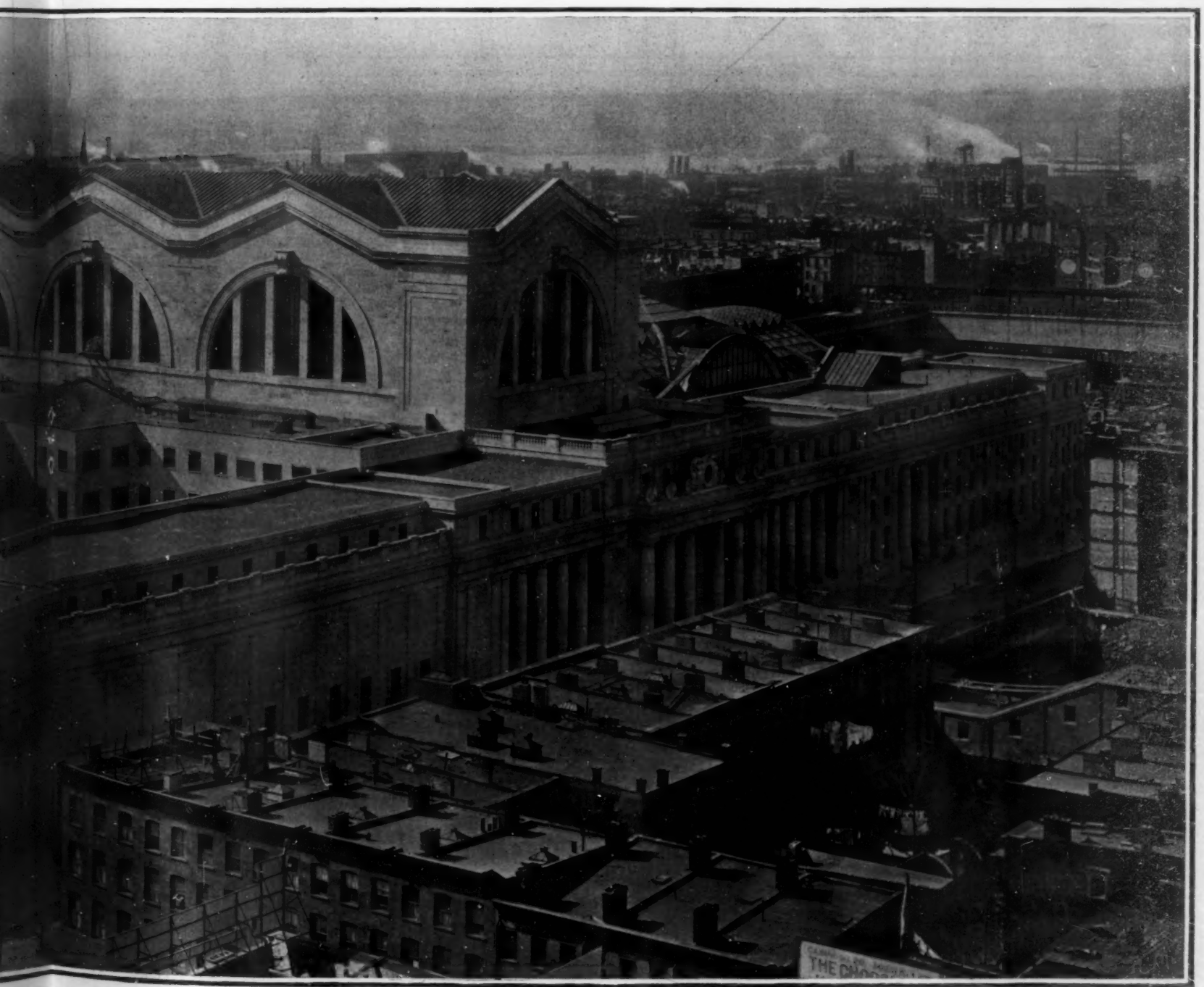
This stupendous structure, the largest of its kind in existence, covers an excavation out of which the engineers blasted some 3,000,000 cubic yards of rock. This portion of the terminal, whose floor is 40 feet below the street rooms, and the general offices of the railroad. The frontage

BIRD'S-EYE VIEW OF THE SUPERB STEEL AND GRANITE TERMINAL STA



Seventh and Eighth Avenues, is covered by the station building. The whole yard contains 28 acres and 16 miles of track. There are 21 standing tracks and 11 platforms. The yard has also storage capacity for 386 passenger cars.

ARD OF THE PENNSYLVANIA TERMINAL, MANHATTAN ISLAND.



below the street, contains the 21 tracks and platforms, and into it open the tunnels from New Jersey and Long Island. The superstructure, or that portion seen in this engraving, contains the waiting rooms, restaurants, baggage . The frontage is 430 feet on the avenues and 784 feet on the streets.

INAL STATION OF THE PENNSYLVANIA RAILROAD ON MANHATTAN ISLAND.

HOW TO BUILD A HOUSEBOAT FOR $300.

BY FREDERICK K. LORD.

The proposition of spending a summer afloat is one which appeals to many persons fond of the water; but the cost of a yacht large enough to accommodate comfortably a family for a protracted period is prohibitive to the majority, therefore people swelter ashore in hot and uncomfortable hotels, and snatch such enjoyment from the water as chance and circumstances permit.

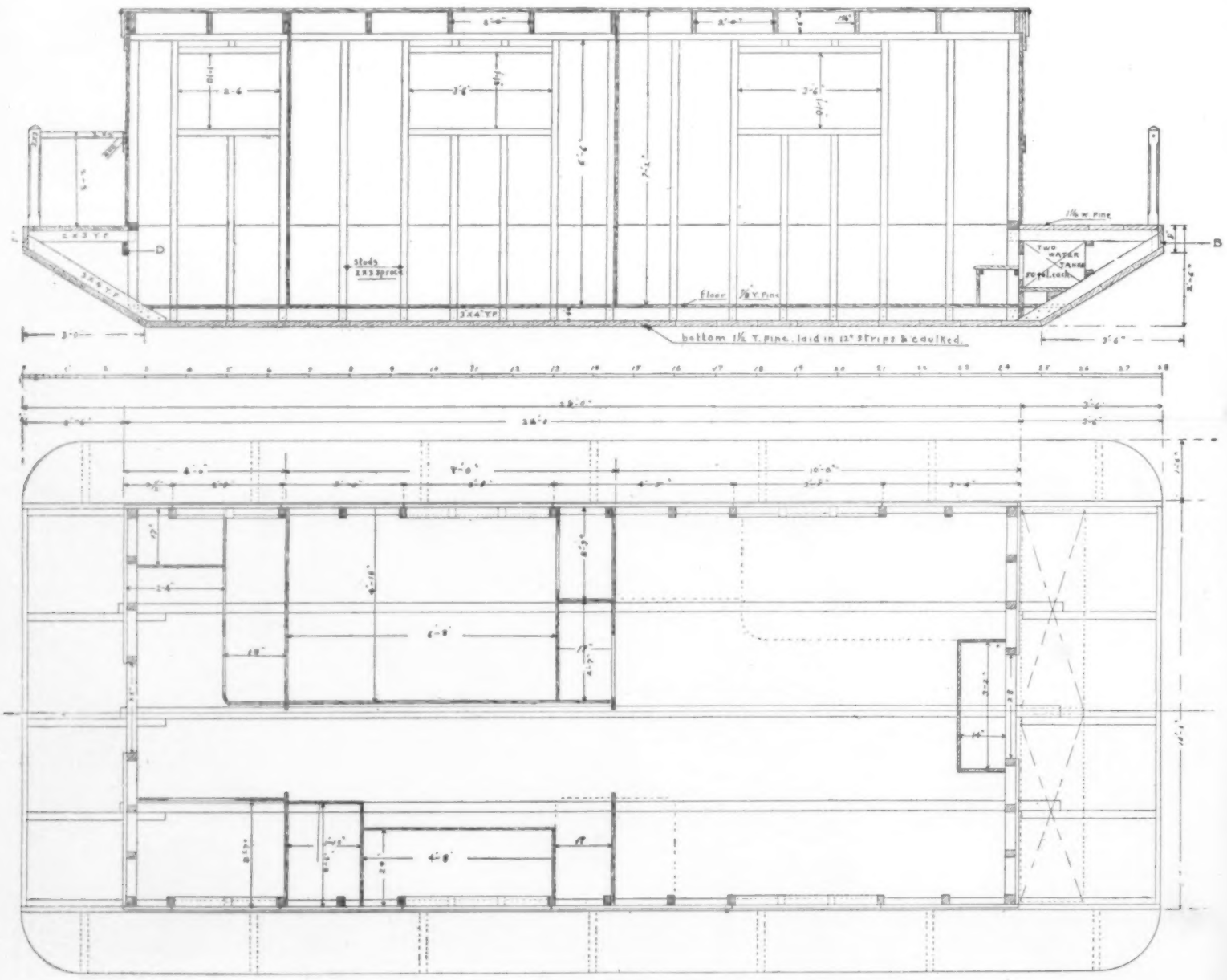
A solution of the problem of living cheaply and comfortably afloat is found in the houseboat. Such a life offers many charms and advantages. It is generally cooler on the water, and the air is fresher and better, being free from dust and land smells. Bathing is always "on tap," and the entertainment of friends is accompanied with more charm and privacy than in a crowded summer hotel. If the locality becomes tiresome the houseboat can be towed to another harbor for a few dollars, and there is no packing of trunks or tipping of servants when getting out of town.

The plans herewith shown represent a small houseboat capable of accommodating four or five persons comfortably for a very moderate price. It would cost four persons fifty dollars a week at an average-priced summer hotel. This amounts to six hundred dollars for three months, without extras. The boat shown here could be built for less than that. Then at the end of summer it could easily be sold for more than half its value or kept for another year. In any case there would be a very large saving over living ashore during the summer season under equally comfortable conditions. The cost of the boat would vary, according to whether it was built by amateurs and how elaborately it was constructed and fitted up. A moderate price shipbuilder should build this boat complete with toilet and water tanks for five hundred dollars. As the boat is very simple in construction amateurs should be able to build it for about three hundred dollars. At a small additional cost an awning could be rigged over the house-top, thereby providing a fine, large, cool lounging space.

For those interested in building such a boat themselves the following hints on construction may prove useful:

The first step in construction is to prepare the ground and build the sides and bottom of the hull. The ground should be prepared by driving posts and using stringers and blocks so placed that the hull may rest during construction on an absolutely level plane. By doing this a level and plumb line can be used to get the house and its compartments built plumb and true. After the building foundation is prepared, start by getting out the sides. These are of 1½ inch yellow pine, laid three strakes to a side. As the depth of the hull is 30 inches the sum of the three planks should be 28½ inches to allow for the thickness of the bottom. The sides are held together by temporary strips of wood screwed to them. When thus secured fasten on the lower inside edges a yellow pine corner log 2 x 4 inches as shown in the cross section plan at *A*. The object of this is to stiffen the edge and afford extra nailing surface for the bottom planks. Now set up the sides in their proper places on the building foundation and be very careful to see that they are perfectly plumb and level, otherwise the whole structure will be crooked. Nail three or four strips across the bottom to hold it in place and then put in the end pieces *B* of the hull. These are of 1½-inch yellow pine. Next put on the planks which extend from the end pieces to the bottom. These planks, as well as the bottom ones, are of 1½ yellow pine, and about 12 inches in width. Proceed to put on the bottom by beginning at both ends and working toward the middle. Plane the planks so that they touch on the inside and are open about ⅛ inch outside. This is to allow the caulking to be driven in and to prevent its being pushed clear through to the inside. In putting the hull together use large galvanized iron boat nails about 4 or 4½ inches long. The corner log, *A*, should be fastened to the sides with ¼-inch galvanized iron rivets, and the bottom planking should be fastened to both log and sides. Be careful that the planking lies perfectly flat and true before fastening, otherwise leaks will surely develop, which are hard to stop. Paint should be applied and a few threads of cotton laid along the edge of the sides to help make a water-tight job. After the bottom is on three 3 x 4-inch yellow pine stringers, *C*, should be fitted and nailed from the underside of the bottom. Carry these stringers up to the ends as shown in the plans. This gives us the bare hull, and we can now proceed with the house frame and small decks at each end.

It might be well first to call attention to the two water tanks that are shown in the drawing. If these are to be put in it is well to do it now, otherwise some



SECTIONAL PLAN AND SIDE VIEWS SHOWING CONSTRUCTIONAL DETAILS OF THE HOUSEBOAT.

A solution of the problem of living cheaply and comfortably afloat is found in the houseboat. Such a life offers many charms and advantages. It is generally cooler on the water, and the air is fresher and better, being free from dust and land smells. Bathing is always "on tap," and the entertainment of friends is accompanied with more charm and privacy than in a crowded summer hotel. If the locality becomes tiresome the houseboat can be towed to another harbor for a few dollars, and there is no packing of trunks or tipping of servants when getting out of town.

The plans herewith shown represent a small houseboat capable of accommodating four or five persons comfortably for a very moderate price. It would cost four persons fifty dollars a week at an average-priced summer hotel. This amounts to six hundred dollars for three months, without extras. The boat shown here could be built for less than that. Then at the end of summer it could easily be sold for more than half its value or kept for another year. In any case there would be a very large saving over living ashore

The next members to put up are the stud beams to take the weather boarding of the house. The beams are of 2 x 3-inch spruce. They should be cut into lengths of 6 feet 11 inches. Jog them over the corner log, *A*, and securely nail them to it. Fasten them to the side of the hull with stout galvanized iron nails, care being taken to get several very good fastenings in the lower side plank. The spacing of these beams will vary on account of the positions of the windows and partitions. The way to do this is to put up, first, all the beams that come at window openings and partitions and then space up equally the intervening beams. The construction plan shows the dimensions and position of the beams. A sill, *C*, of 2 x 3-inch spruce, is now laid on top of the beams and fastened thereto

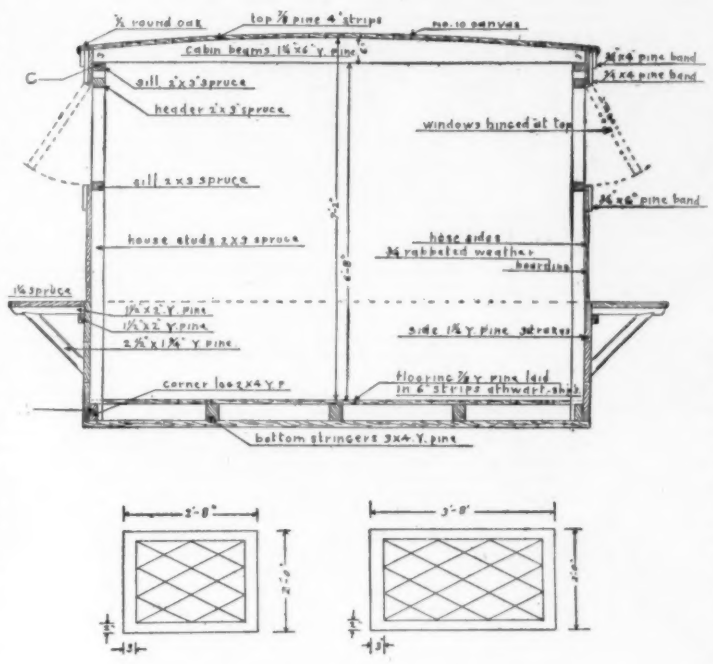
securely. Put in the headers and sills for the windows and the studs immediately under them.

Proceed to finish the decks. Run 1½ x 3-inch yellow pine stringers across the end studs 4¼ inches below where the top of the deck will come. Use 2 x 3-inch yellow pine deck beams, seven to a deck, including sides, and securely nail to the stringer and end board of the hull. A deck of 1¼-inch white pine may then be laid in about 10-inch widths or less, and after being well painted covered with No. 10 canvas. As the run boards on either side of the hull will serve conveniently as a staging for building, it may be well to put them on. The boards themselves are of 1¼-inch spruce planks fastened to 1½ x 2 yellow pine cleats spaced seven to a side, as shown in the plans. They are supported by 1¾ x 2½ yellow pine braces, securely fastened to the hull and jogged into the cleats.

The roof beams should next be put up. These are of 1¼-inch spruce, 6 inches deep at center and 3 inches over sills. This gives a crown of 3 inches, just enough to shed water. The beams are spaced 2 feet on centers except where it may be necessary to vary them slightly so that they may serve as a backing for the partitions.

It is now in order to board up the sides. Use ⅞ x 6-inch rabbeted boards of the type shown in the section. Start from the bottom and lay out the widths, as shown in the plan, so that they will come right for the finishing bands. Nail each board to every stud with two nails, and countersink and putty the heads. The sides are now ready for the finishing bands and window trim. Commencing at the corners, put on the vertical trim of ¾-inch white pine 6 inches wide, and also the door trim. Then the horizontal band under the windows and the strake at the upper edge of cabin, which should be 8 inches deep, and finally the second band at cabin top and the window trim, both 4 inches wide. All the foregoing should be of ¾-inch white pine. The trim at the window openings should be set back so that a shoulder is created by the studs and sills to form a rabbet for the window. The cross section plan will show this. The windows are hinged from the top and swung outward, as indicated.

Proceed to finish up the cabin roof by planking it over with ¾-inch white pine boards laid in 4-inch widths and having a tongue and groove with a beaded edge underneath for a finish in the cabin. Paint the top well and cover with No. 10 canvas laid in a single piece. It can be obtained in widths as high as 12 feet, and it is much better to use the single piece and get rid of seams which are liable to leak. Draw the canvas over the edge of the house, and after securely fastening with copper tacks cover them up with a half round molding, as shown in the plan. The doors and windows should be 1¼ inches thick, and these plans will be sufficient to enable any one to get them out. The doors are of the Dutch type, that is, they open in two sections. They are more handy and convenient when thus made.

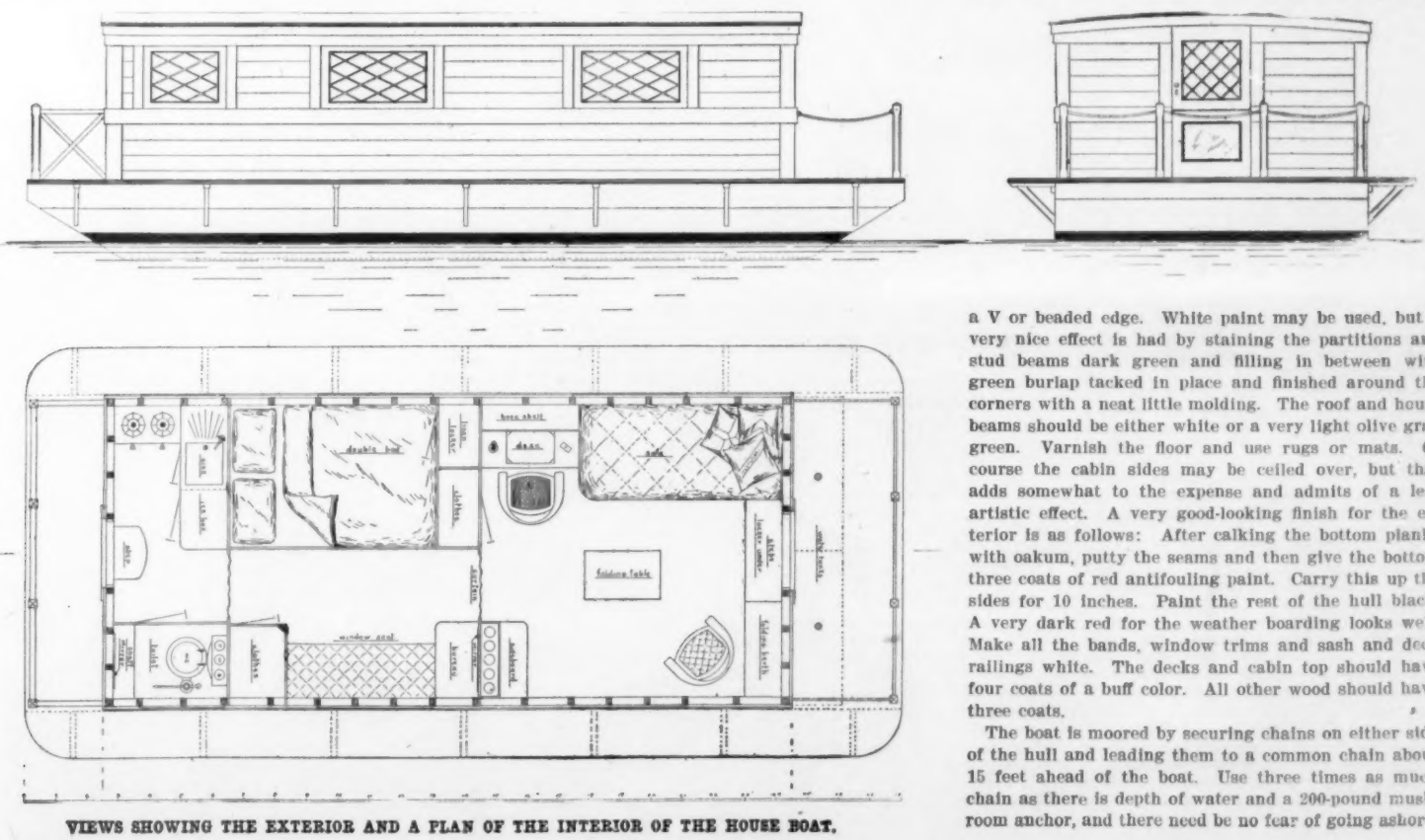


CROSS SECTION OF THE BOAT AND DETAILS OF THE DOORS AND WINDOWS.

An ornamental railing fore and aft, as shown, affords safety and convenience. The after side is fitted with a rope, which can be unhooked to allow boarding the craft. This completes the hull, and we can now turn our attention to the interior.

The first step is to lay the cabin flooring after painting the inside of the bottom. The floor may be of ⅞-inch yellow pine, laid either in 6-inch widths or in narrower widths, with tongue and groove. The former width is perhaps preferable in this case. Begin at one end and plank athwartship on the stringers and corner logs. Sweep out all shavings and sawdust as you proceed. After the floor is laid and smoothed up, the partitions and cabin fittings are ready to go in.

The interior is arranged to provide sleeping accommodation for a mixed company of four. Entering the houseboat from the after end the first compartment comprises the living room, which is turned into a sleeping room for the men at night. The doorstep has a removable tread, and is used as a locker. On the right a 6½ x 3 foot couch is installed, fitted with a spring and mattress. Next to this is a desk with bookshelves above. Upon the opposite side, near the door, is a folding berth, shown standing on end. This is built simply like a hollow box, containing an ordinary spring and mattress. It is lowered down for use and afterward up-ended and held by a couple of hooks. In the opposite corner is a sideboard with glass rack above and drawers beneath to hold table linen. A folding table and two or three easy chairs complete the furniture in this compartment. Of course chairs and couch should be bought, but it would be more satisfactory to make the desk, sideboard and table, and this would not be very difficult if it was done simply of oak, in the mission style, and stained. The next compartment is for the ladies. Here a double bed is shown which may be taken from the house and installed, or built in like a regular bunk with drawers underneath or left open for the reception of trunks. There are two lockers at the foot, one for linen and the other opening into the sitting rooms for the men's clothes. A built-in bureau is shown opposite, and a window seat and clothes closet. The forward compartment contains the toilet with mirror and folding wash-basin on the left and the galley fittings on the right. An alcohol stove is indicated along with a porcelain sink and ice-box under the dresser. Stores may be carried under the forward deck. The partition for the cabin divisions and lockers should be of ¾-inch cypress put up in 3-inch strips, tongue and groove, with a V or beaded edge. White paint may be used, but a very nice effect is had by staining the partitions and stud beams dark green and filling in between with green burlap tacked in place and finished around the corners with a neat little molding. The roof and house beams should be either white or a very light olive gray green. Varnish the floor and use rugs or mats. Of course the cabin sides may be ceiled over, but that adds somewhat to the expense and admits of a less artistic effect. A very good-looking finish for the exterior is as follows: After calking the bottom planks with oakum, putty the seams and then give the bottom three coats of red antifouling paint. Carry this up the sides for 10 inches. Paint the rest of the hull black. A very dark red for the weather boarding looks well. Make all the bands, window trims and sash and deck railings white. The decks and cabin top should have four coats of a buff color. All other wood should have three coats.



VIEWS SHOWING THE EXTERIOR AND A PLAN OF THE INTERIOR OF THE HOUSE BOAT.

The boat is moored by securing chains on either side of the hull and leading them to a common chain about 15 feet ahead of the boat. Use three times as much chain as there is depth of water and a 200-pound mushroom anchor, and there need be no fear of going ashore.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

COAT AND PANTS HANGER.—S. OICHMAS, New York, N. Y. This hanger is adapted to support in a smooth, well-formed manner, the coat and either the pants or skirt of a suit of clothes. It has a supporting bar and a clamping bar co-operating with the bar, the latter being adjustably secured at one end and removably secured at its other end.

Of Interest to Farmers.

CATTLE-GUARD.—L. T. COX, Columbia, Tenn. This invention relates to a type of cattle guards arranged on cross ties of a railroad, and having yielding obstructions mounted upon the ties, that hinder the free passage of cattle over the guard; and has for its object to provide a guard that is effective in service, and greatly obstruct a traverse of the guard by live stock, without injury thereto.

Of General Interest.

BRISTLE-RIM FOR ROTARY BRUSHES.—I. ABRAHMSON, Freiburg, Breisgau, Germany. The improvements in rims consist in making the disks of sheet metal and in providing them with projections pressed out of their material, which projections engage in the bristles and thus take hold of them, whereby, even when the brush rotates at high speed, any loosening of the wire, as well as any shifting of bristles on the circumference of the disks is prevented. Then it is possible to use the brush until the bristles project only a few millimeters beyond the holding disks.

CARTRIDGE.—C. O. PERSON, Banning, Cal. The cartridge is for use in cylinder bore shotguns and like firearms, and arranged to increase the carrying capacity and to predetermine the scattering of the shot at any distance. For this the shot is held in a container, capable of separation from the cartridge casing on firing the explosive charge, the container being provided with means for retaining the shot during a portion of its flight and for turning the container over to allow the shot to scatter.

SHAVING-CUP.—J. PATRONAGGIO, New York, N. Y. This cup has a receptacle at one side and a soap holder at the other side disposed above the plane of the bottom of the soap holder with which the soap is adapted to engage to hold the soap in place when the barber is making a lather by moving a shaving brush across or around the soap.

DENTIMETER.—A. D. CLOUD, New York, N. Y. The purpose here is to provide a device in which the ends of the gage wire may be readily applied and detached. This is done by constructing the instrument with a head at its inner end having slots in the edges at opposite sides. The ends of the wire are passed into these slots and said ends each given a turn or two about the shank of the tool preparatory to twisting the wire loop to the tooth.

WATER-METER.—J. H. CONNELL, Charleston, W. Va. In operation, water enters by a throttle valve, passes into the valve chamber through an opening which is uncovered into the casing body. Force of water swings a vane until it engages and shifts a shifting bar. This swings a plate, and a valve moves to cover the discharge opening. Means provide for the water to flow into the casing until it shifts the bar. The pin and slot connection between the bar and plate permits some lost motion between parts, while the box spring retains the plate in swing position, and insures it a clear swing across the chamber, to move a block to close and retain closed an opening.

TIGHTENER FOR DRUMHEADS.—E. M. YATES, Norman, Okla. Among the principal objects in view in this case are: to provide means for quickly tightening the heads of drums; to provide means for adjusting the tightening devices individually and for operating the same collectively; and to provide a strong, simple and efficient construction for drum bodies and head tighteners.

BABY-HAMMOCK.—W. H. CONNERY, Chattanooga, Tenn. This hammock may be hung from the sides of a sleeping room above the bed of the mother or out of doors on a porch or lawn, and is so arranged as to permit ready access to the occupant. One object is to readily adjust it to any height relative to its support, by an improved means.

ROASTER FOR ORES.—A. J. GARVER, Clarkston, Wash. In this case the invention relates to roasters for use for ores, the more particular purpose being to produce a simple type of roaster in which the ore while heated is brought into minute contact with the air so as to completely desulfurize the ore and otherwise prepare it within a short time for smelting.

PIANO TOUCH-REGULATOR. — W. S. THOMPSON and C. W. BAHR, Fort Collins, Colo. It is well known that pianos are constructed for light and for heavy touch performers. The aim of the present invention is to provide a means for regulating the touch of the action, that is the resistance of the keys to the touch of the performer, and wherein the said resistance may be increased or decreased to suit the individual.

DISPLAY-FIXTURE.—W. E. TAYLOR, St. Louis, Mo. This fixture is more especially designed for advantageously displaying wall papers and the like, and arranged to accommodate a number of wall papers in proper position for view and selection by a customer, and to permit of conveniently removing any one of the displayed wall papers and replacing the same by another.

VENTILATING-SCREEN FOR DOORS.—I. B. SEELEY, Chicago, Ill. This improvement relates more particularly to a device comprising a screen body adapted to be movably mounted near the door, intermediate the top and bottom thereof, and to attach removably to the door when the same is partly closed, so that the ventilating openings are left at the upper and lower portions of the door-way.

SIGN.—F. S. SCHAEFER and W. D. NANCE, North Yakima, Wash. This invention is an improvement in advertising signs, and has in view a sign in which the letters or other symbols on display are illuminated in either artificial or natural light, the symbols in either case presenting clear-cut reflecting surfaces in any ordinarily lighted place.

LOOSE-LEAF BINDER.—T. BRAZIL-DINEEN, Milson's Point, North Sydney, New South Wales, Australia. The invention embodies a box case of two telescoping sections, screws for moving the two sections to and from each other to clamp and release the leaves, and an operating shaft operatively connected to the screws, each screw being incased in telescoping thimbles respectively carried by the opposite sides of the case, and arranged to be received in notches formed on the edges of the leaves when the latter are inserted in binding position between the plates.

DREDGING-SCOOP.—T. S. BARWIS, Vancouver, British Columbia, Canada. The intention in this instance primarily is the provision of a scoop essentially consisting of two opposed scoop members having a pivotal movement to and from each other, and which are operable to effectively claw or dig up the material preparatory to gathering it in.

Hardware and Tools.

SEAL-LOCK.—A. A. DE A. DECASTRO, Sao Paulo, Brazil. The lock can be used with advantage for a safe, and where effective locking means is desired, but is more especially designed to be used with money remitting pouches, mail bags or anything in fact which requires a lock that cannot be tampered with without leaving clear proof of such molestation behind.

ATTACHMENT FOR REPAIR-TOOLS.—W. L. DINSMOOR, Longbeach, Cal. This invention provides a heating plate for vulcanizing purposes, interchangeable with the upper or movable clamping plate on the tool. To this end the plate is preferably cast with an inner passage and has one or more burners on its outer face communicating with the passages, shields over the burners for reflecting the heat to the plate, and a lug for the reception of the clamping screw which operates to force the two jaws or clamping plates together.

Heating and Lighting.

VAPOR-BURNER.—E. B. RAYMOND, Los Angeles, Cal. The invention relates to burners adapted for the combustion of coal oil and its distillates for the generation of heat, and has for its object to provide details of construction for a burner, that render it capable of vaporizing and consuming heavy coal oil, without smoking or depositing of residuum in the burner.

ELECTRIC-LAMP SOCKET.—V. T. BAILEY, New York, N. Y. The present invention has in view to construct and apply a cover in a manner such that the socket ring may be revolved on the socket shell to carry the caps from over the posts and expose the binding screws, thus avoiding the necessity of entirely removing the cover from the base for this purpose.

PORTABLE ACETYLENE-GAS GENERATOR.—O. A. LOVELENS, Watersmeet, Mich. The invention embodies an outer water tank, an inner carbid tank and a cover common to both removably applied the former having bowed springs supporting the latter, having a central stem adjustably connected to the cover and provided with an enlarged pocketed portion at its lower end through which water from the water tank percolates into the carbid tank, and the cover having a conical screen for straining the gas as it leaves the generator, with the screen pointing outwardly.

Household Utilities.

ADJUSTABLE IRONING-BOARD. — J. G. KIRKPATRICK, Prescott, Ariz. In its construction the device includes a leg which rests upon the floor, and an object of the inventor is to provide means for rigidly bracing the board upon this leg, and further to provide improved means for adjusting the board to varying heights or thicknesses of the table edge.

CLOSET-SEAT.—T. G. PHILPOT, Augusta, Ga. This invention is an improvement in water-closet seats of wood. In a seat of this class it provides means for preventing the splitting of the side sections across their deflected ends and this is accomplished in the present instance by means of lugs extending from the ends of the front and rear sections.

REFLECTOR-STOVE.—J. T. REZNOR, Mercer, Pa. Mr. Reznor's invention pertains to reflector stoves, his more particular purpose being to provide a stove to be heated by gas, vapor, or other combustible aeriform body, the construction being such that the heat when produced is distributed advantageously and diffused as nearly equally as possible.

Machines and Mechanical Devices.

PERFUME-VENDING MACHINE.—A. F. VORCE, Benzonia, Mich. This machine comprises a bulb presser for the atomizer, with check-controlled means to lock the presser against retraction in its advanced movement, automatically released as the bulb is pressed, and to lock the presser against advanced movement in its retraction, whereby the presser cannot be withdrawn until the advance movement is completed, nor be advanced after being partially retracted, which prevents the operator receiving but one spray for each check or coin.

INDICATOR.—W. D. STANTON, New York, N. Y. The object here is to provide a machine so constructed that the values thereon can be viewed from different directions when the indicator is projected into a transparent part of the register casing, and in which each indicator consists of a plurality of telescopically arranged units, thereby conserving space and reducing the size of the machine.

COMPRESSOR.—J. D. MAYHEW, Tyler, Texas. This compressor is employed in connection with ammonia, ice or refrigerating machines that compress the gas from the coils into the condenser. One object is to produce means whereby the maximum amount of gas or vapor may be compressed. Further to provide a compressor in which the heat evolved during operation of compressing gas or vapor may be utilized to dry the incoming gas.

WELL-DIGGING APPARATUS.—M. LATTA, Valentine, Neb. In the present patent Mr. Latta provides a settling chamber, and a pumping mechanism by which to exert a constant suction in the settling chamber and a suction pipe discharging to the settling chamber, and to this extent in a broad way the present invention is similar to the apparatus shown and claimed in a former patent granted to this inventor.

RUDDER.—S. B. MCNEELY, Natchez, Miss. More particularly the invention relates to a rudder which is normally inoperatively disposed in a well carried in the hull of the vessel and located near the bow, suitable means being provided for projecting the rudder into an operative position and for turning it to steer the vessel in one direction or the other.

MEAT-SLICER.—A. W. JOHNSON, New Brunswick, N. J. This improvement refers to slicers such as used for making slices from roast beef, corned beef, and similar meats. In its general construction the device presents a cradle upon which the cut of meat rests, and the frame of the device supports a knife toward which the meat is automatically advanced by the operation of the knife.

MATRIX FOR LINOTYPE-MACHINES.—C. W. GRASNICK, Berlin, Germany. The invention relates to an improvement in matrices, whereby many defects are avoided. It consists in reducing the contact surfaces of the side portions to middle parts, which extend over the intaglio letters. Thereby the risk of imperfect fitting of the middle parts of the composed matrices is reduced and a more perfect lock-up of the composed lines is assured.

APPARATUS FOR PREPARING MATRIX-SHEETS FOR THE REPRODUCTION OF WRITTEN MUSIC OR THE LIKE.—F. DOGILBERT, 18 Rue Oberkampf, Paris, France. This machine is for use in printing suitable surfaces by means of suitable characters or type, but it is more particularly suitable for the preparation of matrix sheets intended for use in the reproduction of written music. It is electrically operated and is provided with a controlling arrangement by which regularity in the action exercised by the type on the surface to be printed upon or stamped, is obtained automatically.

Prime Movers and Their Accessories.

OILING SYSTEM FOR ENGINES.—G. W. FAIRFIELD, of the U. S. Navy. In the present patent the invention has reference to oiling systems for engines, and the object of the improvement is the provision of means for use in automatically oiling the wrist-pin and crank-pin bearings of an engine. The oil is provided in a continuous circulation.

INTERNAL-COMBUSTION ENGINE.—O. E. FREAR, Albany, N. Y. Means provide in this case for controlling the inlet and exhaust ports of four-cycle engines by fluid pressure. Both the inlet and the exhaust valves connect with auxiliary pistons mounted in auxiliary cylinders. Means are provided to open the inlet valve which remains open during the suction stroke. No cams, rock shafts, levers or mechanism operate valves from crank shaft or any other moving part of the engine. Gas pressure is utilized as sole means for operating all the valves.

HYDRAULIC-POWER PIPE SYSTEM.—C. A. COMPTON, Washington, D. C. The main object here is to provide a means by which a stream of falling water may be partially deflected in an upward direction and may be again brought into contact with the descending stream, thereby imparting to the latter increased pressure. Further, to provide a means for accomplishing the above which may be applied to any power plant having a turbine shaft and a turbine located at the bottom thereof.

Pertaining to Recreation.

COMBINED HOBBY-HORSE AND VEHICLE.—F. W. FUESSEL, Hicksville, N. Y. More particularly the invention relates to a form of vehicle or cart combined with a hobby horse, so that the person riding on the vehicle will be seated on the horse. By means of certain features, the device may serve all of the functions of an ordinary rocking-horse, or may serve the functions of a cart or ordinary vehicle, or all of the advantages of both may be combined in one.

COUNTER-HOLDER.—C. E. RANEY, Courtenay, N. D. The intention here is to provide a holder for pool and like counters, in which the number of counters remaining in the holder can at all times be easily determined, in which the counters cannot be identified, which serves as a substitute for the ordinary "bottle" commonly used to contain pool counters, and which obviates the occurrence of certain mistakes in the use of the counters.

PUZZLE.—D. E. SMITH, Mount Vernon, N. Y. The idea in this case is to produce a means of affording amusement and interest in attempts at solving a puzzle. The invention relates to that type of puzzles which includes a ring which is apparently attached to other pieces so that it cannot be removed, but the construction is such as to enable the ring to be removed by the exercise of ingenuity, and the manipulation of the parts.

Pertaining to Vehicles.

LOG-RETAINER.—W. DREVER and C. KELLAHER, Tomahawk, Wis. The device embodies a sill having a strap passing around each end from one side of the sill to the other, each strap having at one side of sill a dog pivoted to swing from below the upper face of the sill to upright position, and at the other side a chain latch for securing the holding chain of the opposite dog, with further means, whereby the dog at one side of the car or vehicle is locked and released at the opposite side of the car.

VULCANIZING-IRON.—W. L. DINSMOOR, Longbeach, Cal. This iron is to be heated by acetylene gas from the acetylene lamp generator, and is provided with a flat and concave vulcanizing face with one or more intermediate combustion chambers, the flat vulcanizing face serving to apply the patch to inner tubes, and the concave vulcanizing face serving in a like capacity for outer tubes while the latter remain in place on the motor vehicle wheel.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 13th, 1909, or will be sent by mail on request.

(12221) E. S. L. asks: Have you a SUPPLEMENT or other paper that will give me a plain explanation of the principle of the radiometer? A. The explanation of the rotation of the radiometer is given in Barker's "Physics," page 395; in Carhart's "High School Physics," page 293; in Hoadley's "Elements of Physics," page 224; and in most of the textbooks of physics. Some one of these will doubtless be within your reach. All these agree that the blackened faces absorb heat more than the bright faces of the mica disks, and thus become hotter than the bright faces. In turn they radiate the heat more rapidly, and thus a reaction force of the nature of a pressure is produced, which causes the fly to turn just as a rotary lawn sprinkler is turned by the reaction of the pressure of the water. An iron ball heated below redness will cause the radiometer to rotate in the dark, showing that light is not necessary to produce the effect, but that heat alone is competent for the explanation of the instrument. It was at first thought that light caused the rotation, but that has been abandoned.

(12222) O. R. says: Relative to Query 12217 in issue of April 2nd, 1910, the distance of the moon—240,000 miles—is only the *radius* of a circle; the circumference or orbit would approximate 1,440,000. T. H.'s calculation would then work out so that the moon would subtend an angle of one-half degree, which practically corresponds with the telescopic measurements. A. In Query 12217 the writer used the radius of the moon's orbit where he should have used the diameter, and so all his calculation was wrong. Otherwise his reasoning was right, and he would have found the moon's apparent diameter to be a half degree had he not made this mistake.

(12223) C. L. W. asks: That introducing resistance into a circuit reduces the number of amperes flowing is of course plain, according to Ohm's law; the amperes being equal to the electromotive force divided by the resistance in ohms. I have also always been under the impression that resistance introduced into a circuit reduced also the effective

voltage of the circuit after the current had passed through the said resistance, and that the voltage would *fall* according as more or less resistance was introduced. The following experiment is therefore hard to explain, if this is so: We connected two 110-volt lamps in series on a 220-volt circuit, and in the opened point as shown below, after the current had first passed through the lamps, inserted a large standard voltmeter, which read 218 to 220 volts. This was repeated many times, with the greatest precautions as to connections; and also on other sources of supply, and the results were the same, in a general way, apparently no drop of any appreciable extent having occurred by the passage of the current through the lamps, although of course the amperes were cut down. What is the explanation of this? Much discussion has arisen over it, and the claim made that the voltage should have been reduced. A. The case of the lamps and the voltmeter as you describe it is no exception to Ohm's law. The resistance was not that of two lamps in series, but of two lamps and a voltmeter which had a resistance of many thousand ohms. The current in amperes became inconsiderable because the resistance was so high, and the voltmeter registered only the voltage. The voltage would be the same as if the lamps had not been in series in the line. No amperes were flowing, or at most a very small fraction of one ampere. The point is this: the voltage at the end of an open circuit is the same as that anywhere along the circuit. The drop between any two points of a closed circuit is proportional to the resistance between those two points. If the circuit which you show in your figure had been closed the lamps would have been lighted, showing that current was flowing, and the voltmeter would then have shown 110 volts drop between the two terminals of each lamp. This is in strict accordance with Ohm's law.

(12224) C. A. Y. says: Why do not seven new gravity cells connected in series give about 7 volts after being set up and short-circuited for 24 hours? I bought seven gravity cells for use in charging a 6-volt-60 A. M. P. hour storage battery, but I cannot make them give more than about 2¾ to 3 volts, although each one gives a particle over one volt, and two in series show about 1½ volts, and three in series about 1¾ volts, etc. A. We are not prepared to say positively why you have so low a voltage for your battery in series. If we saw the battery, we might be able to tell what is required. We suspect that you kept it on short circuit too long, and that the zinc sulphate solution is saturated. If the colorless liquid reached down nearly or quite to the coppers, this is the case. You should take out some of the zinc sulphate from the top and fill in with water again.

(12225) J. B. says: I have a magnet needle belonging to an old surveyor's compass which has lost its magnetism. Will you please tell me through Notes and Queries how to renew it? A. The best mode of magnetizing a compass needle is to draw it across the pole of an electromagnet. If you use the north pole of the magnet, draw the south end of the needle last from the north pole. After drawing the needle from the north pole of the magnet several times reverse the needle and draw it across the south pole of the magnet, drawing its north end last from the south pole of the electromagnet. A compass needle may probably be magnetized sufficiently by drawing it in the same way across the poles of a horseshoe magnet. If you have not the apparatus for doing this, take the needle to the electric light station and ask the engineer to magnetize it for you.

(12226) B. B. says: 1. What is brake horse-power? A. The brake horse-power of a machine is the power it can exert as determined by means of a brake upon the axle or pulley of the machine. You will find an article upon this mode of measuring power in our SUPPLEMENT No. 1737, price ten cents. 2. What is meant by ultra-violet? A. The ultra-violet region of the spectrum is the part which the eye cannot perceive because the waves are too short to affect the retina. The longest waves below the red do not affect the retina and are also invisible. To these the name "infra-red" is given. The colors of the rainbow run from the red through yellow, green, and blue to violet. Beyond the violet the eye can see nothing. But there is a very large region there which can be explored by other means, such as the photographic plate or the flourescent substances.

(12227) C. H. W. says: I would like to hear through your columns a satisfactory explanation of the following: Take an ordinary flat-iron and a gasoline torch such as is used by plumbers, etc. Lay the flat-iron on its side, and turn the full force of the torch against the face of the iron. Water will now condense and collect in large drops on the face of the iron, and will continue to collect until the iron gets hot enough to evaporate the water. A. All natural atmospheric air contains a certain proportion of moisture, i. e., water evaporated and in suspension. Most gasoline also contains a percentage of water. Consequently the gasoline vapor in a torch or engine contains moisture, being a mixture of air and gasoline. Upon the hot gas or flame impinging upon a cold iron or other surface, the moisture is condensed just as the moisture in your breath, otherwise invisible, is condensed into little drops of water on a cold window pane when you breathe upon the latter.

NEW BOOKS, ETC.

THEORETICAL PRINCIPLES OF THE METHODS OF ANALYTICAL CHEMISTRY. Based Upon Chemical Reactions. By M. G. Chesneau. Translated by Azariah Thomas Lincoln, Ph.D., and David Hobart Carnahan, Ph.D. New York: The Macmillan Company, 1910. 8vo.; 184 pp. Price, $1.75.

The book takes up the influence of the physical state of precipitates upon their purification by washing, the theoretical principles involved in methods based upon irreversible reactions, as well as a study of methods based upon reversible actions. In Chapter III we have the study of principles involved, according to the calorimetric theory, in reversible actions; in Chapter IV the presentation of the electrolytic theory of these reactions, and in Chapter V a comparison of these two methods. The next chapter deals with the general processes which produce complete precipitation in double decomposition, and inversely which cause precipitates insoluble in water to become soluble. In the final chapter the principles established in the preceding chapters are applied to some particular methods based upon double decomposition.

THE EVOLUTION OF WORLDS. By Percival Lowell. Pp. xiii + 262; 12 plates and 56 text cuts. New York: The Macmillan Company, 1909. $2.50 net.

To those who are familiar with Prof. Lowell's books on Mars, the cosmogony which he outlines in this latest work of his must come as a surprise. In his earlier works he pinned his faith to the La Place nebular hypothesis; now he practically adopts the Moulton-Chamberlin "planetesimal" theory, without calling it by that name, which seems like to a reversal of himself. Mr. Lowell's proneness to see markings upon other planets than Mars finds expression once more in this volume, for we note that he still insists upon the appearance of dark spots on Venus, spots which he regards as fixed features, and which no other astronomer has ever seen. Contrary to the usual supposition that Venus is surrounded by a dense atmosphere, Mr. Lowell holds that its atmosphere is of the thinnest, and that the planet's brightness is due to the attenuated atmosphere. The sections on Mars reiterate his well-known views on the habitability and gradual decay of that planet. The book is written in Mr. Lowell's usual style, a style which is most attractive to the lay reader, but which is characterrized by occasional chasing of the odd word, and therefore affected at times. For good, popular scientific reading, even though it presents only the very personal views of its author, the book is certainly to be commended.

HANDBUCH FÜR HEER UND FLOTTE By George von Alten. Berlin, Leipzig, Stuttgart, Vienna: Deutsches Verlagshaus Bong & Co.

The two installments of the "Handbuch für Heer und Flotte" which lie before us begin with "Bristol" and end with "Carnotscher Kreisprozess." Among the articles which deserve to be particularly mentioned are those on Bronze, "Brücken" (an excellent exposition of the various types of bridges employed for military purposes) "Brasilien" (a good geographical and military consideration of the biggest country in South America), "Burg" (in which various forms of mediæval strongholds are considered).

HEALTH PROGRESS IN THE ADMINISTRATION OF THE WEST INDIES. By Sir Rubert W. Boyce, M.D., F.R.S. New York: E. P. Dutton & Co., 1910. 8vo.; 328 pp. Price, $3.50.

The epitomized record of the progress or sanitation and sanitary administration in the West Indies is the outcome of a visit which the author paid to the West Indies in 1909 in order to investigate an epidemic of yellow fever which was present in the colonies of Barbados at the time. While making the investigations on the subject of yellow fever in Barbados, he was requested by the Governor of the Windward Islands and the Governors of Trinidad and British Guiana to prolong his stay and visit their respective territories and report upon the health conditions obtaining in these colonies. The results of the author's experiments as described in the present volume is of value not only to the medical and business man, but also to the tourist who wishes to reside in or visit these beautiful colonies. The book is beautifully illustrated with interesting half-tones.

THE PLANT CELL. By Harold A. Haig, M.B., B. S. Lond. London: Charles Griffin & Co., Ltd. Philadelphia; J. B. Lippincott Company, 1910. 12mo.; 207 pp.

The author's aim has been to deal with the study of structural and physiological botany from a biological standpoint, in which the working substance of a cell, namely, the protoplasm, is given the first place in importance; the subsequent changes which are produced in form, function, etc., being looked upon as being due to the sole agency of the protoplasm, influenced by the various physical and chemical stimuli which may be brought to bear upon it. This method of dealing with the cell, whether animal or vegetable, has been found, in the writer's experience, to be a rational and useful one when such a wide subject as biology is first approached by the student. The section on cell division has been presented in rather full detail, on account of the great importance attached nowadays to cytological phenomena in which the nucleus is involved. With regard to the illustrations, a few photomicrographs have been inserted, and these give a rather more realistic aspect to one or two of the more difficult sections, such as those on embryology and nuclear division.

THE UTILITY OF ALL KINDS OF HIGHER SCHOOLING. An investigation. By R. T. Crane. Chicago, 1909. 8vo.; 331 pp. Price, $1.00 net.

This edition gives further results of the author's investigation of the utility of academic or classical education for young men who expect to pursue a commercial or industrial career. The following subjects have been investigated and studied: Technical Education in Manufacturing; Technical Education in Civil Engineering; Technical Education in Electrical Engineering; Agricultural Colleges; Manual Training in the High Schools; Business Education; Medical Education; Scientific Education; Rural Schools.

ON THE TRAIL OF WASHINGTON. By Frederick Trevor Hill. Illustrations in color by Arthur E. Becher. New York and London: D. Appleton & Co., 1910. 276 pp.; 8vo. Price, $1.50 net.

For more than a century Washington was exalted as a model of manners and morals—and portrayed as a prig; he was idealized as a hero—and rendered unreal; he was glorified as the father of his country—and denied all human fellowship with his kin; he was invested with every virtue, and divested of all virile character. That he survived in the affections of his people is the best demonstration of his true greatness. Of recent years, however, there has been a notable effort to depict the man as he really was, a man with good red blood in his veins, good common sense in his head, good kindly feeling in his heart, and a good honest laugh. This humanizing of Washington has been the work of eminent editors, historians, and collectors, and their investigations during the past twenty years have virtually revealed Washington to Americans for the first time. It is to place before readers, young and old, the results of this modern research that the writer retells the story of Washington in these pages.

THE DESIGN OF CONDENSING PLANTS. By F. W. Wright. London: The Technical Publishing Co., Ltd., 1909. 203 pp.; 12mo.; illustrated. Price, $1.50.

Considerable attention has been devoted during the past few years to the subject of condensing equipment for steam plants, and scattered throughout the technical press and in the published transactions of engineering societies, are to be found a number of valuable papers embodying the results of careful and extended observations and experiments by able investigators. So far, however, as the author knows, there was no book devoted exclusively to a consideration of the various problems involved, and in many of the standard text books on the steam engine, the references to the question of condensing are very brief. The pages are a modest attempt to supply the lack in a volume of such dimensions and price that it should be within the reach of all who are interested in the subject.

SCIENTIFIC LIVING FOR PROLONGING THE TERM OF HUMAN LIFE. The New Domestic Science, Cooking to Simplify Living and Retain the Life Elements in Food. By Laura Nettleton Brown. New York: The Health-Culture Company, 1910. 284 pp.; 12mo. Price, $1.00.

A great truth is emphasized in this book, namely, that in the ordinary processes of cooking the organic elements become inorganic and food values are destroyed. This dietetic idea is most important, and it is claimed by the author that when generally known and made practical it will restore the racial vigor as nothing else can, free woman from the slavery of the cook stove and become a large factor in the solution of the servant problem. The volume is thoroughly sensible and enlightening; original without being cranky, radical without being faddish; withal, practical, plain and entirely helpful.

HOVEY'S HAND BOOK OF THE MAMMOTH CAVE OF KENTUCKY. A Practical Guide to the Regulation Routes, With Maps and Illustrations. By Horace Carter Hovey, D.D., F.G.S.A. Louisville: John P. Morton & Co., Inc., 1909. 64 pp.; 16mo. Price, 25 cents.

The writer is well known to the readers of the SCIENTIFIC AMERICAN, having written many articles on the subject of caves and caverns for its columns. The present book may be regarded as an excellent guide to the Mammoth Cave and should be in the hands of all those who may think of visiting this unique wonder.

ENGINEERING THERMODYNAMICS. By C. F. Hirshfeld, Professor of Power Engineering, Cornell University. New York: D. Van Nostrand Company, 1910. 16mo. boards; 78 pp. Price, 50 cents.

The following pages represent an attempt to develop the principal thermodynamic properties of gases and of vapors in such a manner that the underlying principles may be clearly recognized. It is thought that a thorough understanding of the laws developed in the text will, on the one hand, give a working knowledge sufficiently extensive for most engineering purposes, or on the other will enable the student to more easily follow the generalized and complicated cases considered in the large standard works on the subject.

SHELL-FISH INDUSTRIES. By James L. Kellogg, Professor of Biology in Williams College. New York: Henry Holt & Co., 1910. Illustrated by half tones and original drawings. 8vo.; 361 pp. Price, $1.75 net.

This fills a much-needed gap in the literature of natural history, or what may be called applied natural history. It covers the classification, propagation, and distribution of shell fish. For the person who eats oysters, clams or scallops, there is information on their structure, life-histories and habits. A chapter is devoted to shell-fish as collectors and carriers of disease organisms. The oyster culturist will find the life history of bivalves from the egg period to the time when they reach the market, a comparison of various culture methods, and a description of oyster fields in various parts of the world.

HALLEY'S COMET. By David Todd, M.A., Ph.D., Professor of Astronomy and Navigation and Director of the Observatory, Amherst College. New York: The American Book Company, 1910. 8vo., paper. Price, 50 cents.

The major portion of this pamphlet on comets is a reprint of the comet chapters of Prof. Todd's "New Astronomy." The reprint is preceded by an introduction in which the usual information on Edmund Halley and the manner in which he applied Newton's law of gravitation to the comet of 1682 is described, as well as the circumstances of the comet's present return. On the whole, it must be stated that of all the cheaper works which have been published to meet the popular demand for a simple account of Halley's comet, Prof. Todd's is the most accurate and the most informing.

THE PASSION PLAY OF OBERAMMERGAU. Translated from the German text, with a Historical Introduction. By Montrose J. Moses. New York: Duffield & Co., 1910. 12mo.; 118 pp. Price, $1.50 net.

The volume before us is printed on delightful light-weight paper, so that we have no hesitancy in recommending it as an ideal text for visitors who are going to have the supreme pleasure of witnessing the Passion Play. The text which is sold in Oberammergau and Munich is apt to be bad and very dear, and it is really good economy to take along a book like the present volume with its black faced readable type. The writer of this book review had the pleasure of seeing the Passion Play in 1890; he therefore thinks that possibly he is competent to review a book on this subject. There are a number of important features. The list of *dramatis personae* are contrasted with various years, such as 1890 and 1900. The history of the Passion Play is given with valuable notes referring thereto. The four ancient texts of the Oberammergau Passion Play are then examined. The description of the play house, etc., follows, together with the statement issued by the Burgomaster showing the ratio of expense to receipts. This shows that in 1890 the salaries of the 747 players were only $48,000, or an average of $64 each, which is not very large pay for an all summer's work which interferes very materially with their regular pursuits. This shows that the Passion Play as regards the members is not very much of a money-making scheme. There is however a considerable amount made each year the Passion play is produced by those who have concessions of various kinds, such as the photograph concession. The text itself of the play is admirable and is followed by the best bibliography of the subject which we have ever seen.

THE ROMANCE OF MODERN CHEMISTRY. A Description in Non-Technical Language of the Diverse and Wonderful Ways in Which Chemical Forces Are at Work, and of Their Manifold Application in Modern Life. By James C. Philip, D.Sc., Ph. D. Philadelphia: J. B. Lippincott Company, 1910.

For a book frankly intended for popular reading, it must be confessed that the author has succeeded in producing a most readable account, which ought not to exact too much intellectual effort on the part of the reader in endeavoring to follow the development of chemistry, and to discover some of its modern achievements. The subjects discussed are the following: Dawn of Chemistry; Alchemy and the Philosopher's Stone; Nature's Building Material; Invisible Substances and How We Know of Their Existence; Elements with a Double Identity; Metals, Common and Uncommon; Where Two Metals are Better than One; Acids and Alkalis; Natural Waters, and What They May Contain; Chemical Changes which Produce Light and Heat: How Fire Is Made; Nature's Stores of Fuel; More About Fuel; Flame, What Is It? Explosions and Explosives; Below Zero Chemistry at High Temperatures; Chemistry of the Stars; Chemistry and Agriculture; Sugar and Starch; Fats and Oils; How Man Competes with Nature; The Adul-

teration of Food; The Value of the By-Product; Valuable Substances from Unlikely Sources; Chemistry and Electricity; Some Interesting Facts About Solutions; From Solutions to Crystals; Great Effects from Small Causes; How Trifling Observations Lead to Great Discoveries.

COMETS. Their Origin, Nature, and History. By Henry W. Elson. New York: Sturgis & Walton Company, 1910. Illustrated; 54 pp. Price, 50 cents.

In this little book Mr. Elson has presented in readable and shapie form the more elementary facts relating to comets. In an introductory chapter on the solar system and stars he traces the relation between Newton's discovery of the law of gravitation and the Copernican theory of a heliocentric planetary system. With some regret we notice that he illustrates his explanation of gravitation with the old fable of Newton's apple, for which Voltaire is responsible and which has long been discredited. No attempt whatever is made to explain the physical constitution of comets or to give any explanation of tail formation or a summary of recent spectroscopic study, omissions which may have been intentional because of the difficulty in setting forth the more difficult aspects of cometary phenomena in a short, popular essay.

THE INTERPRETATION OF RADIUM. Being the Substance of Six Free Popular Experimental Lectures Delivered at the University of Glasgow, 1908, by Frederick Soddy, M.A. New York: G. P. Putnam's Sons, 1909. 8vo.; 256 pp.; 31 illustrations. Price, $1.75 net.

The substance of half a dozen popular lectures given at the University of Glasgow are here presented in book form. The matter has been rewritten so as to secure continuity of treatment. The subject is presented in non-technical language, and is intended to be of service to workers in other fields of investigation as well as to the general public. The recent important discoveries of Prof. Rutherford and his experiments with Dr. Geiger in counting the number of alpha particles expelled by radium have been added to the book. Altogether the work will be found most interesting to the general reader.

NAUTICAL SCIENCE. In Its Relation to Practical Navigation. Together with a Study of the Tides and Tidal Currents. By Charles Lane Poor, Professor of Astronomy in Columbia University. New York and London: G. P. Putnam's Sons, 1910. 8vo.; 31 illustrations; 11 plates; 329 pp. Price, $2.

Astronomy finds its most practical application in navigation. However, many a navigator knows very little astronomy, as most of the astronomical matter which is necessary for the guiding of his vessel is presented to him in the form of tables and formulæ which he accepts without inquiring into their mathematical significance. The present work attempts to explain in non-technical language and without the use of complicated mathematical formulæ the fundamental facts and principles that form the basis of all navigational methods. A large part of the book is devoted to an explanation of tides and tidal currents, and their causes, giving the recent researches of Dr. Harris, which show that the tides of each ocean basin are practically independent of those of the rest of the world.

LUDWIG DARMSTAEDTERS HANDBUCH ZUR GESCHICHTE DER NATURWISSENSCHAFTEN UND DER TECHNIK. Von Professor Dr. L. Darmstaedter. Berlin: Verlag von Julius Springer, 1908. 1262 pp. Price, $4.

It would be difficult indeed to exaggerate the importance of this chronology of inventions and scientific discoveries. The names of the distinguished editor and his collaborators are in themselves sufficient guarantee of the accuracy of the work and the painstaking labor which its compilation involved. For all that no one can possibly realize how arduous must have been the task of preparing this work without having actually handled the book itself. Its 1200 odd pages are packed with concise and yet lucid statements of the principal scientific and mechanical discoveries year by year, beginning with 3500 B.C. and ending with 1908. An admirable index facilitates reference.

PHYSICAL AND COMMERCIAL GEOGRAPHY. A Study of Certain Controlling Conditions, of Commerce, by Herbert Ernest Gregory, Albert Galloway Keller, and Avard Longley Bishop. Boston and New York: Ginn & Company, 1910. 8vo. 269 pp. Price, $3.00.

From the time when they are first offered to the child for study, the facts of production and trade have been listed rather than interpreted. The books which have dealt with these matters have been prevailingly of a statistical nature and the study of what they have had to give has too often reduced itself to a mere mnemonic exercise. And yet there are behind the facts of trade, as behind all facts, certain principles about which they can be grouped, and which serve to lend them life and meaning; and it is interpretation rather than arbitrary memorizing which is of educational importance. The present work which is intended to be used as a text book, is based on a consideration of this idea. It is seldom that we see the authorship of a book split up into three parts, the result, however, in this case appears to have been beneficial, and it has undoubtedly added much to the value of the book that three professors of science have co-operated in its production. It is a most excellent book which can also be added with advantage to the library.

SCHOOL ARCHITECTURE. A Handy Manual for the Use of Architects and School Authorities. Compiled by William George Bruce. Milwaukee: Johnson Service Company, 1910. 18mo.; 285 pp. Price, 50 cents.

The present edition embodies a decided advance over the former efforts and a practical departure in plan of presentation. In scope it is extended so as to include every phase of scientific school-house planning and to embody the latest and best thought and experiment on the subject. In presentation an entirely new plan has been adopted. Instead of presenting all subjects in topical form, arranged in alphabetical order, it has been planned to arrange the subjects with a view of giving them logical sequence and continuity. The ready reference feature which was emphasized in the former editions is preserved in an ample index and table of contents.

INTERNAL LUBRICATION OF STEAM ENGINES. By T. C. Thomsen, M. Soc. D.C.E. London: The Technical Publishing Co., Ltd., 1910. 12mo. 97 pp. Illustrated. Price, $1.00.

This book has been written in the hope of it proving to be of some assistance to mechanical engineers directly interested in the satisfactory running of steam plants; to improve the internal lubrication of their engines; and if they have troubles, to give such information as will be useful in determining the nature of the trouble and the probable cure. Designers of steam plants may also find points of interest and value in scheming means for applying cylinder lubricants, and the best way of distributing them to the internal surfaces needing lubrication. Very little is said about the chemical and physical properties of cylinder lubricants, or about the various methods employed in distilling and refining, the main points under consideration being the mechanical side of the question.

TAVERNS AND TURNPIKES OF BLANDFORD, 1733-1833. By Sumner Gilbert Wood. Blandford, Mass.: Published by the author, 1908. $2.00.

In no small degree the tavern and turnpike story shapes and describes the social development of a town like Blandford, so rich in fact and incident, so the author concluded to publish this monograph before running the larger risk always attaching to the publication of the conventional local history, the circulation of which is necessarily narrow. Should this little volume meet with such response as to warrant the venture, it is the author's intention to follow it with another on the "Homes and Habits of Ancient Blandford." The book is a monument of industry and many of the illustrations which are given show bits of old New England.

FREIGHT TRANSPORTATION ON TROLLEY LINES By Charles S. Pease. New York: McGraw Hill Book Company, 1909. 16mo. 62 pp. Price, $1.00.

Generally speaking the freight business of a traction road is more profitable than its passenger service, while with electric traction lines this relation will not obtain, therefore, the subject of goods transportation is worthy of the close study of the company intending to follow as far as may be expedient the practice of the great trunk lines. A monograph on the subject is therefore far from being out of place. The whole subject seems to have been treated in an admirable manner. Special attention is given to stationery.

CEMENT AND HOW TO USE IT. Edited under the supervision of William A. Radford. Chicago: The Radford Architectural Company, 1910. 8vo. 369 pp. Price, $1.00.

The present volume has been prepared in response to numerous requests for a treatise written in simple non-technical English which will serve the purpose of a plain working guide to the seclusion of cements and aggregates, the purpose of proportioning and mixing concretes, and the rules obtaining in the many forms of construction to which it has shown itself so well adapted. Throughout the volume constant emphasis is laid on the product as distinguished from the theoretical mode of treatment. On account of the intimate relation which cement and concrete now bear to every branch of construction, the present volume will be of great practical value not only to concrete workers but to all other craftsmen engaged in the various trades of the building industry, such as carpenters, steel workers, plumbers, engineers, and others.

THE DESIGN AND CONSTRUCTION OF OIL ENGINES. By A. H. Goldingham. New York: Spon & Chamberlain, 1910. 16mo. 260 pp. Price, $2.50.

This work has been written with the intention of supplying practical information regarding the kerosene or oil engine, and in response to frequent requests received by the writer to recommend such a book. Whilst many works have been published on the subject of gas engines, some of which refer to or describe the working of the oil engine, no other book, it is believed, is devoted entirely to the oil engine in detail. The work, it is hoped, will be found useful to the draftsman, the engine attendant, as well as to those who own or are about to instal oil engines. The classification of vaporizers has been adhered to as made some few years ago, and a representative engine with each type is described.

FOOLISH QUESTIONS. By R. Goldberg. Boston: Small, Maynard & Co., 1909. 18mo.; ill. Price, 50 cents.

The present volume is a reproduction of cartoons which were originally published in the New York Evening Mail.

AUF VORPOSTEN IM LEBENSKAMPF. Biologie der Sinnesorgane, I-Fühlen U-Hören. Von Dr. H. Dekker. Stuttgart: Kosmos Gesellschaft der Naturfreunde. 92 pp.; 33 illustrations.

This is a popularly worded treatise on the biology of the sense organs, devoted chiefly to tactile sensations or peripheral sense organs.

MATTER AND SOME OF ITS DIMENSIONS. Washington, D. C.: Woodward & Lothrop. 99 pp.

SELECTED SHOP PROBLEMS. By George O. Seaton. Peoria, Ill.: The Manual Arts Press. 12mo.; 16 plate and 15 pages of text.

GILLETTE'S INDUSTRIAL SOLUTION: WORLD CORPORATION. By Melvin L. Severy. Boston: The Ball Publishing Company, 1908. 8vo. 594 pp. Price, $1.50.

Legal Notices

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China cabinet and table, combined, J. H. Bennet 956,619
Churn, F. O. Homme..... 956,639
Churn, W. F. Smithdeal..... 956,835
Clinometer, line, E. H. Holden..... 957,059
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Clover huller, J. W. Clutter..... 956,886
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Coffee cleaning apparatus, W. D. Balcom.. 957,138
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Combs, etc., apparatus for making, J. Wilcox 956,560
Compressor, G. D. Warren..... 957,129
Computing device, W. J. Rainey..... 956,998
Computing machine, J. M. Daly...956,687, 956,689
Concentrator, P. McFarlane..... 956,777
Concrete roadway, oiled, E. M. Chadbourne. 956,940
Condiment holder, G. B. Clemmer..... 956,942
Conveyor, C. D. Seeberger..... 956,606
Conveyers, flight attachment, A. J. Frase.. 956,520
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Cooking utensils, device for greasing, F. B. Bradbury 956,929
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Corn crib, R. D. Raiston..... 956,903
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Coupling, F. C. Bowles..... 956,753
Cover fastener, F. W. Garrett..... 956,524
Crane, H. W. Jacobs..... 956,856
Crib, rocking, Walton & Keim..... 956,913
Crown block, F. S. Barkelew..... 956,926
Crushing roll, R. Bernard..... 956,878
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Current motor and generator, single phase alternate, V. A. Flynn..... 956,845
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Cuspidor cleaner, E. Huddart..... 956,641
Cutting machine guard, S. B. Blanchard.. 956,564
Damper control, automatic, H. Peterson.. 956,542
Dental attachment, W. J. Brady..... 957,032
Denture, E. B. Crane..... 956,843
Depositing box and time stamp, C. A. Nauck 957,093
Diaper cleaner, G. M. Scott..... 956,831
Dies, machine for engraving or sinking, Keller & Warman..... 956,769
Display card, T. E. Wiedersein, Jr..... 956,916
Display device, A. S. Spiegel..... 957,119
Door, screen, B. C. Rockwell..... 957,100
Double facer, F. Busald..... 956,794
Draft mechanism, six-horse, H. Messman.. 957,076
Drill mounting, C. C. Hansen..... 956,900
Driving mechanism, C. W. Wilhelm..... 956,658
Driving mechanism, W. A. McKinney..... 956,721
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Dust remover, vacuum, J. G. Meyer..... 956,862
Dye, orange vat, J. Deinet..... 957,039
Dye, vat, J. Deinet.....957,039, 957,041, 957,042
Dye, vat, P. Tomaschewski..... 957,125
Dye, vat, J. Deinet..... 957,146
Egg batter, desiccating, J. M. Hussey..... 957,061
Egg preserving device, D. A. Callaway..... 956,568
Egg separator, M. Burrmeister..... 956,678
Elastic cellular filling material, apparatus for use in the manufacture of, Caldwell & Pfleumer..... 957,034
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Electric machine, dynamo, E. M. Tingley.. 956,549
Electric machine, dynamo, Webster & Davis 956,554
Electric machine, dynamo, F. B. Howell.. 956,855
Electric machines, brush holder for dynamo, E. M. Tingley..... 956,548
Electric machines, brush holder for dynamo, C. B. Auel..... 956,666
Electric machines, coil shield for dynamo, Webster & Duff..... 956,553
Electric machines, means for cooling dynamo, H. Roos.....957,102, 957,103
Electric switch, Champ & Schutt..... 956,679

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TWO NOVEL MOTOR SLEDS.

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touches the ground, appears to stand still, while the sleigh slides over it. This is the motion that actually takes place, for the top of the chain travels forward at twice the speed of the sleigh. It will thus be seen that in reality the lower part of the chain in contact with the ground constitutes a surface over which the vehicle itself can move.

The driver has his position on a box behind the engine, which seat forms a receptacle for tools, spare parts and other accessories. That the vehicle has great climbing power has been conclusively proved, for it will ascend steep banks of earth and ride over serious obstacles easily and without any appreciable diminution in speed.

Although this sleigh can carry a party and full equipment, its actual function is to act as a tractor for the haulage of ordinary sledges, the trailing vehicles carrying the loads. Upon completion by the builders, the tractor was taken to Norway by Capt. Scott, and submitted to some exacting trials on snow-covered Lake Fefor and the tumbled country in its vicinity, where the conditions were somewhat analogous to those prevailing around the south pole. Heavily laden trailing sledges were hitched on to the tractor and numerous journeys were made among the Norwegian ice fields. The vehicle proved itself fully capable of withstanding rough usage, and Capt. Scott expressed his complete satisfaction with the results achieved.

Very different from this sled in design is one which has lately been put to a series of severe running tests over all kinds of ice and snow in the district of the Silian Lake, Sweden. The accompanying photograph of the motor sleigh was taken in the Easter days of this year, after the above-mentioned tests had been carried out.

The design differs from that of other automobile sleighs in the driving mechanism. The sleigh is propelled by two driving wheels, each fitted with a number of steel paddles between which an elastic frame is fixed. This simple construction thus combines the advantages of a paddle wheel and the Canadian snow-shoe, having the propelling capacity of the former on fixed ice and snow surfaces, and the supporting and friction capacities of the latter on loose snow. The flexibility of the frame tends further to prevent the snow from clogging by expelling it from the paddles. The driving wheels run in the tracks made by the sleigh runners, and thus tend to make a good contact surface for the paddle wheels. In case the snow is not compressed enough by the runners, the paddle wheels sink by their own weight into the snow, and compress it sufficiently by means of the frame. The paddles engage with the compact snow by cutting through the crust as knives, and work on account of their breadth, against such a large wedge of the frozen snow surface, that an effective counter pressure is obtained which would otherwise be impossible if the driving wheels were, for instance, provided with spikes instead of paddles. The sleigh is in this instance driven by a 6-horse-power double-cylinder air-cooled gasoline motor. The motor sleigh illustrated is designed to serve only as a traction engine, to which any kind of sleigh can easily be attached or detached within a few minutes.

It is of course easy to make the motor sleigh as self-contained as an ordinary automobile, and the electrically-driven forerunners of this sleigh were successfully built in this way.

The motor sleigh is governed by means of a very ingenious and reliable steering device for remote hand operation. The power required for steering is transmitted from the operating hand-wheel through flexible steel tubes to the motor.

In the tests a speed of 24 miles an hour over a smooth ice surface was attained. When traveling over the snow and ice-covered roads, which were in a very bad condition on account of the prevailing thaw, a speed of 10 miles an hour was attained, the total weight drawn being over one ton. During a running test of several consecutive hours, the average speed was 19 miles an hour.

The inventor is a Swedish engineer, Mr. H. Hakanson.

An Industrial Laboratory for the Improvement of the Incandescent Lamp.

Although the establishment of a research laboratory by a large manufacturing organization is not a novelty, the inception by such an organization of a laboratory which has for its object the development of science rather than the improvement of some industrial commodity is probably without precedent. For that reason, Mr. E. P. Hyde calls attention in a recent number of Science to the new physical laboratory of the National Electric Lamp Association, even though it is still only in a formative state. The object of this laboratory is scientific, the specific purpose being the development of those branches of science with which the art of lighting is closely associated. The fundamental idea which has prevailed in the organization of the work is the proper co-ordination of physics and physiology, the proper co-operation of the physicist, the physiologist and perhaps the psychologist.

The organization of the laboratory is proceeding with this idea as the foundation. The development contemplates no sharp distinctions among the different divisions of the work. The problems to be investigated, however, group themselves roughly into three classes, and therefore require, in order to insure the proper attention to each, a threefold division in the organization. The three groups of problems to be investigated may be classified as: (1) those that have to do with the production of luminous energy; (2) those that have to do with the utilization of luminous energy, and (3) those that have to do with the effects of luminous and attendant radiation.

Under the first class will come the investigation of the laws of radiation, and of the radiating properties of matter. The problems in this class are purely physical and the corresponding division will be intrusted to a competent physicist.

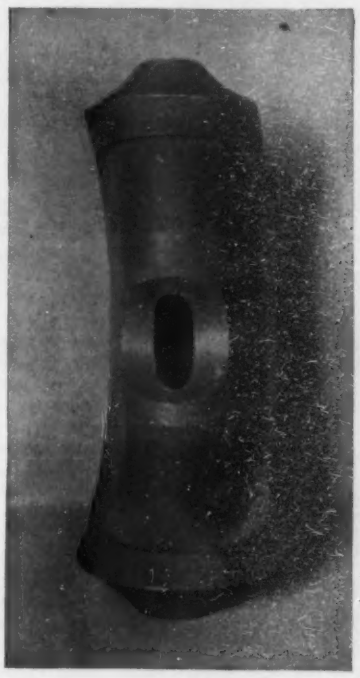
Under the third class will come the investigation of the effects of light and the attendant radiations on the eye, on the skin and on microscopic organisms. The problems in this class are physiological, and the corresponding division is under the charge of a trained experimental physiologist.

Intermediate between these two classes of problems (the first and the third) which are distinctly different, there is another (the second) which forms the connecting link. Touching on one side the physical production of light, and on the other the physiological effects of light, this intermediate division of the work will embrace most of the scientific problems peculiar to illuminating engineering. Investigations of the absorbing, reflecting and diffusing properties of matter, the measurement of light, i. e., photometry, and the study of the complex phenomena of color and color sensation, properly come within the scope of this department of the work.

Scientific Cider Making.

Messrs. Alliot and Gimel recently presented a paper to the Académie des Sciences concerning the good results obtained in the production of cider by washing the apples with an oxidizing solution. Inasmuch as cider is the usual beverage of the populations of the north and west of France, its manufacture should concern hygienists as well as technicians. In many cases the quality of the product is much inferior to what it should be were the process well carried out. The washing of the apples is indispensable to free them from the impurities which they carry, but we must also take account of the defective quality of the water which is available in many cases. The authors' previous re-

(*Concluded on page 408.*)



THIS VANADIUM STEEL GEAR BLANK

is 5½ inches in diameter and was bent cold—flat upon itself as shown, without a sign of a crack or fracture.

Vanadium is an elementary metal; it melts at 3600 degrees F.; alloyed with iron in the proportion of one to two, it melts before the fusing temperature of iron or steel, and as Ferro-vanadium may be thus added to the foundry ladle, the open-hearth furnace or the crucible, to molten iron or steel.

When so added it combines with oxygen and nitrogen and removes these gases in a fusible slag, making the remaining metal dense, non-porous, homogeneous and stronger to a marked degree.

Its action is consistent because while it increases the tensile strength and elastic limit of steel, it maintains the ductility, as may be seen from this experiment.

A pocket knife with a Vanadium steel blade will cut chips from a steel spike. A carpenter's saw of Vanadium steel will cut through a two-inch gas pipe unharmed. Locomotive cylinders of Vanadium cast iron wear five times as long as ordinary iron without reboring. Forgings from Vanadium steel ingots are the strongest, most elastic and longest lived forgings possible. Vanadium steel springs, owing to their freedom from crystallization, wear three times as long as carbon steel springs.

You are getting only partial results if you don't use Vanadium steel. Its marked wearing qualities commend it as the only material for railroad switch points and crossings, high-duty parts of all machinery, springs, gears, axles, and all forgings.

Descriptive booklets free

AMERICAN VANADIUM COMPANY
331 FRICK BUILDING
PITTSBURGH, PA.

(Concluded from page 407.)

searches showed them that oxidizing agents could be used to advantage, and they experimented with hydroxyl, ozonized water, and hypochlorites of soda and of lime in solution in the water which is used for the washing. Used in the proportion of 40 to 60 centigrammes per liter of water (0.4 to 0.6 per 1,000), which is more than enough to destroy pathogenic germs of the human species, they find that hypochlorite of lime has a good influence on the activity of the pectase, which is the coagulating diastase of the pectic matters of the juice of apples. Where the fruits carry much impurity they should first be washed in ordinary water before immersing them in the oxidizing solution. The tests carried out first in the laboratory in 1905 were pursued in the cider-making districts during the seasons of 1907-8 and 1908-9, and they led to the following conclusions: First, the addition of hypochlorite of lime in the above proportions according to the state of purity of the fruit, assure the purifying of the doubtful waters as to bacteria for the present purpose. The juice of the fruit thus treated is found to clarify rapidly. The coagulation of the pectic matter is always well carried out and we have formed an abundant brown surface layer. This assures the stability of the cider with time in this respect. The diastases, especially the maloxydase, are eliminated by precipitation, so that we avoid the principal cause of darkening of the cider. It is also found that the hypochlorite has a favorable selective action on the *Saccharomyces mali* and a destructive action on the anaerobic germs, and it thus solves practically and simply the problem of a pure fermentation. By adding to this treatment the method of repeated under-drawings, we can obtain cider which will keep much longer, and this is of interest for producing bottled cider. There is no harmful matter introduced by the present process. Comparative analysis of cider made from treated and from untrated apples shows a marked advantage in favor of the former.

Military Kites.

Kites, as well as dirigibles, captive balloons, and aeroplanes, may be made serviceable in military scouting, and their simplicity makes them especially valuable. Furthermore, they can be employed with any velocity of wind between 16 and 66 feet per second, whereas the use of a captive balloon becomes difficult if the velocity of the wind exceeds 26 feet per second. Experiments recently made at Boulogne by Capt. Saconney show that it is quite practicable to carry two persons by means of a large kite. The kites used in his experiments were of the Cody type with four sustaining planes and with triangular stabilizing wings. In this method of construction each rectangular cell is strengthened by diagonal rods of bamboo to which the stabilizing wings are attached. The apparatus consisted of a series of kites connected together, for the purpose of supporting the cable, and of a second series of kites attached to a very light carriage, which moved along the cable, and from which the car or basket was suspended.

Kites can nearly always be used at sea and on the coast. They are simpler and less expensive in every way than balloons and they are also strong and easily repaired. These qualities should make them valuable for many purposes in military and especially in naval operations.

A wireless telegraphy station near Berlin claims to have established a record in combined overland and sea transmission of wireless messages. The station recently succeeded in maintaining wireless communication with a Woermann liner during the entire voyage from Hamburg to the Cameroon. The greatest distance signaled was 6,600 kilometers (over 4,000 miles). Although messages had to pass over the Alps, the Algerian tableland, and the Adamana Range, communication was, it is stated, effected with astonishing ease.

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Electrotype plates, bending, P. M. Furlong. 956,522
Electrotype plates, plate holder for use in bending, P. M. Furlong..... 956,521
Elevating apparatus, box and package, A. O. Brigance..... 956,756
Elevator control device, automatic, L. J. Milke..... 957,077
Elevator interlocking safety device, Lumley and Hillman..... 956,536
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Engine power gage, steam, G. Cipollina.. 956,680
Engine starter, E. N. Rittase..... 956,646
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Engine timer, internal combustion, J. A. Schneider..... 957,109
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Envelop machines, discharging device for, F. L. Schmidt..... 956,736
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Fan and sunshade, combined, R. Greenfield. 956,959
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Fastener strips, machine for making corrugated and saw-toothed metal, E. S. Norton..... 956,540
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Feed grinder, Dennis & Rice..... 956,892
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Filling machine, F. C. H. Strasburger.... 956,867
Filling machine, C. L. Bastian..... 956,876
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Filter and controlling valve therefor, P. S. Ward..... 956,914
Filter, water, M. Gessler..... 956,698
Finishing process, Todd & Batty..... 956,550
Fire engine, chemical, E. M. E. Hansen.. 957,054
Fire hose, antidrip device for, Beers & Bumpus..... 956,562
Firearm silencer, R. A. Moore..... 956,717
Firearms, firing mechanism for, A. Miller.. 956,593
Firearms, single trigger mechanism for, W. H. Price..... 956,825
Flask, W. C. Bogenschutz..... 956,621
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Flue blower, G. W. Bernauer..... 956,670
Flue cleaner, V. G. Becker..... 956,668
Flue stopper, G. O. Terry..... 956,610
Fluid regulator, G. J. Leber..... 956,585
Flushing apparatus, P. S. Millice..... 956,863
Flushing device, Bassett & Hunter..... 956,875
Food products, container for, L. H. Backeland..... 957,137
Foot-rest, C. E. Clarke..... 956,681
Frame, See Truck side frame.
Friction drive mechanism, O. P. Grau.... 956,958
Frogless switch, J. J. Newman..... 956,992
Fuel briquet, D. C. McCan..... 956,901
Fuel economizer, E. R. Phillips..... 957,173
Fuel press, D. C. McCan..... 956,902
Furnace, J. W. Hays..... 957,158
Furnace grate, T. Dawson..... 956,517
Furnaces, crown or cover of electric, P. Girod..... 956,699
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Fuses, tester for electric blasting, F. Beattie..... 956,877
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Garbage and recovery of by-products, destruction of, W. M. Cross..... 956,569
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Gas engine, L. C. Vanderlip..... 957,017
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Gas, method of and apparatus for producing, E. E. Slick..... 957,006
Gas producer, E. E. Slick.....957,006, 957,007
Gas producers, automatic water regulator for, J. P. Nawn..... 956,818
Gases from their mixtures, separation of, Levy & Helbronner..... 957,170
Gasolene engine, J. C. Bennett..... 956,881
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Grain saving device, J. Marshall..... 956,591
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Grain separator for attachment to threshing machines, W. J. McAdams..... 956,719
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Greenhouse or the like, portable, E. C. Kline..... 956,771
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Hammers, nail holder for, H. Schneider.... 957,108
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Harvesting machine, beet, J. E. Nix..... 956,821
Hat guard, R. S. Wiesenfeld..... 956,917
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Heating appliance, Spengler & Sidway 956,742, 956,783
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Heating system, hot water, H. L. Bruce.. 956,677
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Hinge, door, F. Schwarz..... 956,738
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Ice clipping machine, W. Z. & F. P. Dalgety..... 957,038
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Internal combustion engine, two cycle, E. A. Meyer..... 956,814
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Jail cell walls, interchangeable bottom for, D. F. Youngblood..... 956,787
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Joint, See Rail joint.
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Kinetoscope, L. Hetz..... 956,528
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Lawn trimmer, O. H. Watkins..... 956,654
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Level, J. Schmid..... 956,830

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READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated.

MUNN & CO., Inc.

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WANTED by a firm of Sheffield, England, Steel Manufacturers, a firm to sell First Class Quality High Speed Steel and Superior Quality Files. Only applications from those who can command business will be considered. For further particulars apply Box 27410, T. B. Browne's Advertising Offices, 163 Queen Victoria Street, London, England.

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FOR SALE.—Collapsible step ladder, patented Feb. 4, 1908, and Feb. 15, 1910. Patent numbers 878,332 and 949,614. Address P. O. Box 182, Brooklyn, N. Y.

Inquiry No. 8987.—Wanted, the manufacturers of the Van Winkle Woods & Sons, and the Weber power meters.

FOR SALE.

FOR SALE.—A number of Corundum, Alundum and Craigleith Stones, sizes ranging from 20" to 27" dia., 1¼" to 3" face. Some of the wheels are straight face others beveled. These are offered at very attractive prices and those interested may secure prices and inventory by communicating with the Bausch & Lomb Optical Co., Rochester, N. Y.

Inquiry No. 9014.—For manufacturers of machinery, supplies, etc., to equip a small plant for the manufacture of iridium-tipped gold nib making for fountain pens.

TYPEWRITERS.

REAL REMINGTON, $18.75.—One machine only in new localities to secure desirable agent. Special agents prices supplied on all makes of typewriters. 3 ribbons $1.00. Standard Typewriter Exchange, 23 Park Row, New York.

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LISTS OF MANUFACTURERS.

COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address Munn & Co., Inc., List Department, Box 773, New York.

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Inquiry No. 9083.—Wanted, the address of firms manufacturing small beer brewing plants, from 75 to 100 gallons a day.

Inquiry No. 9090.—Wanted manufacturers of suspender and supporters supplies, also patent adjustable bachelor buttons.

Inquiry No. 9092.—Wanted, the address of some firms who manufacture permanent lamp wicks.

Inquiry No. 9094.—Wanted address of The Thomas Arithometer Company, also Burkhart Arithometer Company.

Inquiry No. 9096.—Wanted, the address of manufacturers of spiral welded pipes, possessing great strength.

Inquiry No. 9097.—Wanted, address of makers of impulse water wheels.

Inquiry No. 9098.—Wanted, name and address of the manufacturers of the osoniser.

Inquiry No. 9099.—Wanted, address of manufacturers of machinery for making wire cables.

Inquiry No. 9101.—Wanted, addresses of manufacturers of a dip or magnetic needle, for exploring for iron ore.

Inquiry No. 9104.—Wanted, addresses of manufacturers under the name of A. O. Co. Standard.

Inquiry No. 9107.—Wanted, addresses of manufacturers of small emery files (pieces of emery in the shape of a file).

Inquiry No. 9109.—Wanted addresses of the manufacturers of the Dion Desk Clock.

Inquiry No. 9113.—Wanted name and address of the manufacturers of the Russell Patent Automatic Ink Well.

Inquiry No. 9114.—Wanted name and address of manufacturer of the Auto Lantern Globe. Fits all lanterns.

Inquiry No. 9115.—Wanted a machine for making pen nibs, similar to Wm. Mitchell's G. & J. nibs and Waverly nibs.

Inquiry No. 9117.—Wanted names and addresses of the manufacturers of pedometers.

Inquiry No. 9118.—Wanted, a muffler for a gasoline engine, built upon the principle of the Maxim silencer, recently brought out for use on rifles.

Inquiry No. 9119.—Wanted, name and address of the manufacturer of Zeglin bullet-proof cloth.

Inquiry No. 9120.—Wanted, the address of the Ideal Fuel Feeder Co.

Inquiry No. 9121.—Wanted, manufacturers of cut stencils for fancy work, sofa pillows, etc., and oil colors and brushes for same.

Inquiry No. 9124.—Wanted, name and address of a company in Germany making a machine to manufacture a cement and asbestos shingle and building lumber.

Inquiry No. 9127.—Wanted, address of L. Dermigny, manufacturer of a family ice machine for $10.00

Inquiry No. 9132.—Wanted, manufacturers of a gasoline traction engine with a hoisting attachment; in other words, the machine will be used as a portable stump puller to pull sassafras roots, used in making oil of sassafras.

Inquiry No. 9134.—Wanted, a small hydraulic motor, capable of giving about one horse power with a water power of 35 lbs. per square inch.

Inquiry No. 9135.—Wanted, name and address of manufacturers of the Parshall Compressed Air Ice Machine.

Inquiry No. 9136.—Wanted, the name and address of a skunk raising farm.

Inquiry No. 9137.—Wanted, a device that will braid leather strips for horse whips.

Inquiry No. 9138.—Wanted, the address of manufacturers of machines capable of forming a number (12 or more) of pieces of paste about 36 mm. x 32 mm. x 6 mm., made of lead oxide and sulphuric acid, and placing them into a frame having a separate compartment for each piece, the space between each piece and the next being all round 4 mm. The process could be somewhat similar to biscuit making.

Inquiry No. 9139.—Wanted, the name and address of some manufacturer of a coffee mill run by water motor.

Inquiry No. 9140.—Wanted, manufacturers of disc records for graunaphones that use a sapphire point instead of a steel needle.

Inquiry No. 9143.—Wanted, name and address of the manufacturers of an air mattress.

Inquiry No. 9144.—Wanted, manufacturers of machinery for making soda water tubes, commonly known as straws,

Inquiry No. 9145.—Wanted, to buy machinery to load blasting caps or detonators.

Inquiry No. 9146.—Wanted, address of firms engaged in die cast work.

Inquiry No. 9147.—Wanted, manufacturers of machinery for making manilla rope and all kinds of ropes from fibre of century plants, such as maguey, agave, bonikon, sazeviera or any such fibres.

Inquiry No. 9148.—Wanted, manufacturers of machinery for weaving bags of fibre, also manufacturers of machinery for separating fibres as above mentioned from their respective plants,

Inquiry No. 9149.—Wanted, manufacturers of machinery for roasting coffee for small and large industries.

Inquiry No. 9150.—Wanted, manufacturers of machinery for the manufacture of French heels for ladies' shoes.

Inquiry No. 9151.—Wanted, manufacturers of cocoanut oil machinery.

Inquiry No. 9152.—Wanted, the address of the Graham Safety Lamp Filler and Ventilator.

Inquiry No. 9153.—Wanted, name and address of manufacturers of a knotless clothes line.

Inquiry No. 9154.—Wanted, name and manufacturers of a newspaper vending machine.

Inquiry No. 9155.—Wanted, the address of manufacturers of an electric milking machine.

Inquiry No. 9156.—Wanted, the name and address of manufacturers of a rust proof oil, known as Cachouc Oil.

Lewis, L. Ciardelli	956,938
Lifting jack, A. Halvorson	956,577
Light fixture, extension, C. M. Pitel	956,823
Lime, hydrating, W. H. Kemler	956,977
Linen smoother, C. Ellis	956,693
Linotype machine, J. B. Allen	956,790
Liquid cooler, J. Allan	956,788
Liquid separators, liner for centrifugal, C. A. F. Ramstrom	957,092
Lithographic printing plates, producing, W. Gerb	956,764
Loader, portable, Mogg & Gardner	956,816
Lock, J. H. Wilkins	956,561
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Locking device for rotative parts, F. A. Schluns	956,605
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Locomotive blower and air pump exhaust pipe, F. L. Holcomb	956,706
Locomotive, rack rail, C. A. Pratt	956,732
Loom, filling-replenishing, J. Northrop	956,726
Loom, picker stick check, S. D. Eubanks	957,047
Loom shedding mechanism, P. Labonte	956,980
Loom temple, J. Northrop	956,725
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Mail collecting apparatus, J. A. Steinmetz	956,743
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Main and pipe cleaner, Greenan & Redford	957,051
Manure loader, J. Nold	957,085
Mash and the like from noxious odors and flavors, freeing fermented, A. P. Stitzel	956,650
Masts, poles or the like, protecting means for, O. F. Weinlig	956,656
Match box and holder, F. O. Kullander	956,809
Measuring and dispensing can or tank, A. G. Sherman	957,005
Measuring instrument, electrical, P. MacGahan	956,714
Metal bending machine, H. E. Parmenter	956,541
Metal scraping machine, P. R. Bissell	957,031
Metal structure, P. M. Wege	956,556
Metals in solution, separating, Gates & Dow	956,753
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Metalic tie, E. Cronin	956,628
Meter register, L. H. Nash	957,082
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Milk can, top rim, cover, and lock, R. Belitz	956,511
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Milling machine, Le Blond & Groene	956,643
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Mower, lawn, G. A. Culver	957,145
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Pasteurizer, H. Christensen 957,055
Pen, self-filling fountain, B. Grieshaber 956,895
Pepper boxes and the like, top for, Cruikshank & Rock 957,037
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Phonograph record mold, E. L. Aiken 956,922
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Printing wheel, L. S. Dement 956,891
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Pump, Myers Toulin 956,990
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Pump, portable vacuum, J. H. Templin 956,784
Pumping air or other fluid, Wiedemann & Templin 956,839
Pumping apparatus for vacuum cleaners and the like, W. H. Keller 956,975
Punch, center, R. A. Hogge 956,765
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Rail joint, C. D. Russell 956,828
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Rail tie and fastening, B. Wolhaupter 957,022
Rails, anticreeping device for, B. Wolhaupter 957,021
Railway beds, method and construction for the prevention of sink holes in, D. Marconi 956,987
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Razor, safety, C. F. Smith 957,008
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Shafting, flexible, D. Schoening 956,737
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Sharpener, scissors, I. O. Day 956,518
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Soldering iron and blow torch, combined, H. E. Adams 956,921
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Spinning ring, E. A. Bingham 956,930
Spoke and felly clip, J. Humphreys 956,806
Spraying apparatus, J. I. Thornycroft 957,014
Sprinklers, strut for automatic, G. I. Rockwood 956,733
Squeegee, fountain, C. Brown 956,506
Stacker, F. Wyatt 956,840
Stamps, labels, or the like, and for selling postage stamps, apparatus for affixing postage, E. Haas 956,526
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Switch stand, E. N. Strom 956,834
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Telegraphic relay, I. Kitsee 956,808
Telegraphy, wireless, F. G. Sargent 957,001
Telephone attachment, A. G. Howard 956,530
Telephone attachment, J. Kuhn 957,067
Telephone bracket, R. M. Vick 956,911
Telephone, coin controlled, R. L. Bowman 956,754
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Toy building block, S. W. French 956,632
Track sander, J. H. Watters 957,019
Train order holder, A. W. Vick 957,018
Tramways and railways, brake for, P. J. Pringle 956,826
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Trestle, adjustable, G. H. Ratledge, Sr. 957,094
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Truck, side frame and journal box, car, G. G. Floyd 956,633
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Welding thin tubing, H. Lemp 956,984
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Wheel lubricator, vehicle, W. Morris 957,079
Wheel rim, demountable, H. J. Mortensen 957,080
Whiffletree hook, T. E. Ewer 956,630
Window lock, J. F. Sydow 957,124
Window, pivoted sliding, H. Haberle 956,527
Window wiping device, C. A. Kellogg 956,770
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Wrench, S. D. & T. F. Ator 956,924
Yoke, neck, G. W. Frame 956,634

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The adjustment and tuning of a 100-mile wireless telegraph outfit is discussed in SCIENTIFIC AMERICAN SUPPLEMENT 1624.

The theory and action of a 100-mile wireless telegraph outfit is explained in SCIENTIFIC AMERICAN SUPPLEMENT 1625.

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